THE INTELLECTUAL OBSERVER.

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THE LOAN MUSEUM OF ART OF 1862, AT SOUTH KENSINGTON.

(*With a Coloured Plate.*)

BY THOMAS WRIGHT, F.S.A.

It is only within our own time that archæology in this country —and especially the archæology of the middle ages—has really become a science. This is very easily explained. Formerly, any object of antiquity was looked upon merely as a thing in itself. The individual who became possessed of it, if he was a mere collector, put it among his curiosities, or, if he was a man of some information and ingenuity, seemed to think that the mere possession of it gave him the faculty of judgment upon everything connected with it, and he indulged the public with wild speculations, which only brought antiquarianism into contempt, and science was injured by the very discoveries which ought to have benefited it. It was only slowly that people began to understand that one object is of small value unless you have others to compare it with, and even now the notion is not quite obsolete that every man who becomes possessed of an object of antiquity is thereby qualified to write a dissertation upon it. But, the necessity of extensive comparison once understood, it became every day better and more largely appreciated, and, of course, knowledge increased in proportion. Yet this revolution in archæological feeling produced a reaction which also had its evils. Remarkable monuments of mediæval and post-mediæval art had remained concealed in the cupboards of private families, or in small collections which were equally unknown, and these, dragged into publicity by the large pecuniary value which they suddenly obtained, excited a sort of enthusiasm which gave them an undue antiquarian and artistic importance.

The influence of this mistake is still felt very greatly, and the only means of correcting it is an increase of knowledge, by the opportunity of still more extensive comparison. It is the

feeling of this want which has led, during some years past, to the desire of establishing collective exhibitions. The works of art of the middle ages and the renaissance, the pecuniary values of which are very extravagant, are rarely collected in large museums, but are scattered among a number of wealthy individuals, and are thus inaccessible to the general student. The sort of public feeling excited by the announcement of an exhibition of this kind draws from their hiding-places important examples of art, which in some cases would have remained absolutely unknown, with the additional advantage of being placed side by side with similar objects from other collections, and thus, though the opportunity of minute study is not great, people have a chance of obtaining enlarged views on the subject which would not otherwise be accessible. During the last ten years several experiments of this kind have been made, but none on so extensive a scale and so generally satisfactory as the Loan Museum at South Kensington during the past year.

The objects brought together on that occasion were so numerous and so varied, that, although they were classified, it would be useless to attempt anything like a general description of them, except by a catalogue, and a very good catalogue of the collection has been published under the direction of the Science and Art Department of the Committee of Council on Education. But we may try to show briefly the real character of this remarkable assemblage of works of art, the advantages which may be derived from it, and more especially the manner in which it illustrates the history of ornamental art since the period which, in classical language, is called antiquity. This latter view of the subject is the most interesting of all, because it is most intimately connected with the history of human intelligence and social progress.

The love of ostentation is a passion inseparable from humanity, which shows itself in various forms under the different circumstances of society. According to the accounts of the ancient writers, the primitive inhabitants of our island, that is, the uncultivated Britons of the wilder districts, having nothing else to ornament, painted their skins, and thus made the most of their nakedness. For the style of art which thus existed among them we have no other voucher than the imaginations of some ingenious artists, who have attempted to represent pictorially what the ancient writers have only hinted at. We can place no examples of painted Britons in a modern loan museum, and of course Roman art is beside our present purpose; but we are enabled from a very early period to trace the artistic tastes of some of the peoples who united in forming the middle ages, so as to judge even of the individual influence which each exerted in the subsequent amalgamation. In those rude ages,

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F. W. Fairholt, F.S.A.

1. Glass Lamp with painted surface, (Early Arabic.)
2. Ewer, in 'Henri Deux' Ware.
3. Gilt Cup, given by Henry VIII. to Barber-Surgeons' Company.
4. Silver Cup, partially gilt, given by Charles II. to ditto.
5. Cup in black and white Limoges enamel, gilt, (Baron Rothschild.)

and indeed until a comparatively late period, the love of ornament at a particular period was generally confined to not more than one or two classes of objects, and in general the particular class thus distinguished was especially characteristic of the social condition of the age. No one will deny that, if the ancient Britons employed their artistic skill in painting and tattooing their naked bodies, it is a tolerably satisfactory proof that they had little else to display. When, however, we become acquainted with our Teutonic forefathers, we find them in a totally different social position, and we see several directions in which the taste for ornament might be displayed. First, as great warriors, we might suppose them ostentatious of their arms; secondly, they might adorn their persons; and, in the third place, they might make a display of ornamental riches in their dwellings. The remains of Teutonic poetry speak in rather exaggerated terms of the beauty of their arms, but their ornamentation of these appears to have been chiefly lavished on the hilts of swords, and these were distinguished most by the value of the material. Almost the only ornament of the dress which remains is the fibula, which fastened the mantle on the breast, and this, though often large and elaborately worked, shows chiefly a great desire to exhibit the precious metals, for, if not, as in a few instances, of gold or silver, it is of copper, rather thickly gilt, so as to make show of gold. We can easily understand this desire to display the precious metals, when we consider that they formed the most valued part of the plunder of the Roman provinces, and that the possession of them was considered as evidence of bravery in war as well as of wealth. Hence the display in the interior of the Teutonic household was considered the most important of all. Not that the houses were elegantly furnished, for the only important room in the house—in fact, nearly the whole house itself—was the hall, and that consisted of little more than bare walls, but the chieftain stored up in his coffers vessels of Roman goldsmiths' work, formed of gold and silver, which he had gained in his inroads into the Roman provinces, and which he brought out only to display at the festive board. For many reasons, therefore, these were the ornamental objects on which he placed the greatest value, and this explains why, in the earlier periods of the middle ages, the goldsmith's art was one of those held in highest consideration. Vessels of gold and silver, and jewellery, were the works on which chiefly art was employed, and the craft of the smith, as applied to such objects, was considered so honourable that it was exercised by some of the greatest men of the age, such as, in England, Archbishop Dunstan and Bishop Ethelwold. As the church became powerful and wealthy, the ecclesiastics appeared as the great patrons of the goldsmith's art, and the most

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splendid examples were crowded into the treasuries of the cathedrals and monasteries.

The desire to give increasing beauty to these works brought into repute enamel and niello, and other similar contrivances, all of which had been practised by the Anglo-Saxons. But the art of enamelling took a great development towards the twelfth century, when the celebrated manufactory was established at Limoges, it is supposed by Greek artists from the East, and where it continued to flourish till the fourteenth century. During the twelfth and thirteenth centuries this manufactory was extremely active, and an immense quantity of very beautiful enamels was supplied, many examples of which are still preserved. With the Limoges enamel came a great improvement in the style of art. The half-barbarous chieftains of the earlier period valued, in the objects of art they displayed, first, the metal, because it was a measure of their wealth, and therefore of their power; and, secondly, the workmanship, because the more elaborate this was, the more it must have cost to produce it. The skill of the worker in metal was so much esteemed that it was believed to have been first exercised by semi-gods, such as Weland, and by the elves in the mountains, and by them granted to favoured individuals among men. But this skill consisted in ingenuity and labour, for the early artists had little notion of design, and none of correctness or elegance of form. If the objects were made of gold, covered with plenty of filagree-work and such ornament, and glittered with precious stones, or glass, or enamel, it was enough; and when, from the scarcity of the precious metals, or from the greater call for such objects of ornament, it was necessary to make them of cheaper materials with a mere superficial resemblance, all that was required was that the ornamentation should be elaborate and showy. But with the Limoges enamels we trace a decided improvement in art, just such as we might expect to be brought from a country where the tradition of the arts of antiquity was more vivid.

While the art of enamelling was establishing itself at Limoges, another branch of art was becoming more largely developed; this was carving in ivory. It was an art which had grown up in the later Roman period, and seems to have been brought into western Europe from Italy during the Carlovingian period. It was established at about the same time in Germany and France, which countries continued during the middle ages to be those where this art was chiefly cultivated. An ivory carving can only please by its beauty of execution, and it was necessary for the artist to study correctness of form and design. Hence the carvers in ivory were generally the superior artists of the time, and their subjects were pictures. Ivory appears to have

been first used for tablets, on which pictures were carved, chiefly of religious subjects, some serving as portable altar-pieces, and others as provocatives to pious reflection. It was then employed in the construction of small chests or coffers, which also were adorned generally with pious subjects. Many of them were no doubt made for ecclesiastics, or for ecclesiastical purposes; but it is probable also that many of the tablets as well as the coffers were made for ladies, for whom such subjects were considered most suitable. As social life became developed, this destination of the ivory-work becomes more and more evident, and the religious subjects begin to be abandoned, and in their place we find subjects taken from the mediæval romances, especially such as were likely to be favourites with the ladies, from love allegories, etc.; and these are given not only on coffers, but on the frames and cases of ladies' mirrors, combs, and other similar objects. The ivory carvings of the thirteenth and fourteenth centuries, which appear to have been executed most extensively in France, often display a very superior style of art.

During the whole mediæval period, the application of art to pottery seems to have been entirely lost, for mediæval pottery is distinguished only by its rudeness; but the glass-manufactories of the late Roman period appear to have been continued; and, as we learn from the remains found in their graves, the Anglo-Saxons and other Germanic tribes, from a very early period, prided themselves on the possession of vessels of this material, which was especially employed in making drinking cups, which display more artistic taste than most of the objects of art belonging to the same period. We can only here speak of the period before the conversion of the Anglo-Saxons to Christianity, when, in accordance with their pagan ceremonies, they deposited glass vessels in their graves, which has been the means of preserving them; but the material is so extremely fragile that we need not be surprised if, during several centuries, we have so little remains of vessels in glass that we might almost suppose that they never existed. Improvements in glass-making appear to have been introduced from the East, where it was brought to a certain degree of perfection during the thirteenth and fourteenth centuries. A few remarkable specimens of oriental glass, which had found their way into western Europe during the middle ages, have been preserved, and some of them were placed in the Loan Exhibition. They are remarkable for the amount of ornamentation bestowed upon them, and for the different processes employed in ornamenting the material. Some of them are vessels for domestic purposes, but among the more curious are the large ornamental lamps used for lighting the mosques. The best of the three lamps exhibited at South Kensington is

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represented in our plate (Fig. 1). It is nearly fourteen inches in height, and eleven and a-half in diameter, and has six loops for suspension. The medallions on the upper part enclose a device composed of a red chalice-like cup, with a red hemisphere above and a black hemisphere below. Between the medallions and on the body of the lamp below are two inscriptions, the first of which is a verse from the Koran, the translation of which is, "God is the light of the heavens and the earth; the similitude of His light is as a niche in which is a lamp." The inscription below states that the lamp was made by order of the Emeer Sheykhoo, who was a contemporary of the Sultan Hasan, who reigned from 1348 to 1362. This lamp is now the property of Felix Slade, Esq. The celebrated Venetian glass began to be manufactured in the fifteenth century, and the manufacture continued to flourish until the first half of the century following.

At this later date began the great movement for ornamental pottery, for till that period pottery was not admitted as a work of art, but was of rude make and used chiefly for common purposes. The lead in this movement seems to have been taken by an individual whose name is not known, but who flourished in France in the latter part of the reign of François I. and through that of Henri II., and who was possessed of very great artistic taste and skill. It is supposed, from some characteristics of the ware itself, that he was originally a goldsmith or jeweller. Whoever he was, he raised the art of pottery at once almost to its highest pitch of excellence, and, besides the elaborate character of the processes employed in producing it, it was long before pottery again presented the same degree of artistic beauty. It is evident that this "Henri II. ware," as it is called, was at the time looked upon as a great effort of art, and that it was very expensive, for the small number of examples which remain bear upon them the indications that they were all made for the king or for some of the great princes of France. We have given in our plate (fig. 2), as an example of this ware, a representation of an ewer or arguière, which is considered to be the finest of the existing specimens. It is in the collection of Hollingworth Magniac, Esq., and was exhibited in the Loan Museum (No. 1200). It is also the largest specimen, for its extreme height to the top of the handle is fourteen inches and a half, and its greatest diameter is five inches and three quarters. Its elaborate ornamentation will be best described in the words of the authorized catalogue, given in the note below.* This production of artistic pottery

* "The body of the piece is oviform; all the plane surfaces are covered with incrusted interlaced ornament of several different designs; the pattern on the lower part of the body containing the letter 'G,' repeated in the centre of numerous small compartments, formed by the interlaced diaper; on the widest or most salient part of the body four beautifully modelled Medusa masks, in high relief, are attached or applied. The foot or base forms a series of elaborate mouldings,

was followed immediately by the pottery of the celebrated Bernard Palissy, who was, in fact, a contemporary of the anonymous potter-artist of the reign of Henri II. Like the Henri II. ware, the Palissy ware was an imitation of the embossed goldsmiths' work; but it was more grotesque, and displayed far less taste. It was much more curious than beautiful. This manufacture flourished in great activity during the latter half of the sixteenth century, and appears to have been kept up by some of the family, or by imitators, until it fell into neglect on the extensive importation of oriental porcelain, and we have no more European artistic pottery of any great merit until the establishment of the manufacture of porcelain at Sèvres, and the various descriptions of porcelain afterwards manufactured in Germany and in England.

These attempts to introduce high art into the manufacture of pottery had been preceded by a revival of the enamel works at Limoges, although the new enamel differed very considerably from the enamel of the twelfth and thirteenth centuries. The new productions are termed painted enamel, because the surface of the copper was covered with a uniform coating of enamel, usually brown, on which the subjects were painted. This new style of enamel began in the latter part of the fifteenth century, attained its greatest excellence in the latter part of the sixteenth, and fell into decline early in the century following. The example given in our plate (fig. 5), which was exhibited in the Loan Museum by Baron Rothschild, belongs to the best period, about the year 1580. Its form is not inelegant, and the ornamentation is very superior. The ground is a brilliant black, decorated in blue, green, and gold, with heads in circles, painted *en grisaille*, to imitate cameos. The taste for a display of ornamental plate had undergone no diminution during the middle ages, and its manufacture went side by side with the new works in porcelain and enamel. It was at the court of Burgundy that this passion reached its greatest height of extravagance, and the princes and nobles carried their treasures about with them, in

further enriched by applied strap-work scrolls in relief, pecten shells, cherubs' heads, etc. The neck of the ewer, likewise richly diapered with encrusted ornamentation, is divided into two portions by a bead or torus moulding in the centre, the portions above and below this moulding respectively being campaniform, each of the bells being turned in opposite directions. The spout or mouth of the vase is shaped as a large pecten shell, underneath which, in front, another grotesque female mask is attached to the neck of the vase; the handle is formed by a syren with her head downwards and fore-quarters resting on the body of the vase, whilst the extremities are formed by two serpents, which form the elegantly curved grip of the handle; the involuted extremities, where they join on to the large pecten shell at the mouth of the piece, terminate in two serpents' heads modelled with great spirit." It may give some notion of the great value set upon these objects of art of the middle ages and the renaissance, to state that this piece of pottery is said to be worth at least two thousand pounds.

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order that they might display them wherever they halted. Every reader of history remembers the vast treasures in plate and jewellery which Charles the Bold carried with him when he invaded Switzerland in 1476, and how, after his defeat in the battle of Morat, these treasures became the plunder of the Swiss, fell into the hands of dealers, and were soon scattered over Europe. In the progress of ages, plate has been more liable to destruction than most other objects of art, in consequence of the continual tendency to melt it down, in order to employ the metal in more useful purposes, or to make new and more fashionable objects; and hence almost the only examples of early plate which remain, especially of English manufacture, have been preserved by corporate bodies, and have, perhaps, some peculiarity of character, arising from the corporations for which they were made. However, there can hardly be said to be any general character in ancient plate, each example, in a manner, standing by itself; and, instead of attempting to select examples which might serve as types, we have been satisfied to give two which are interesting for their historical associations. The first of these (fig. 3) is a cup, which was given by Henry VIII. to the Company of Barber-Surgeons in London, at the time of granting their charter, an act which is commemorated in a large painting by Holbein, still preserved in the hall of the company. The cup is of silver-gilt, the cover surmounted by the royal arms, with Tudor supporters. The other cup (fig. 4) belongs to the same company, having been presented to them by Charles II., and is intended to commemorate the shelter afforded to that monarch after the battle of Worcester by the oak of Boscobel. It is also of silver, partially gilt; the stem and body represent an oak tree, from which hang little bells in the form of acorns. The cover is surmounted by the royal crown.

In the Loan Exhibition of last year, all these branches of ornamental art, and some to which I have not alluded, were tolerably well represented. The Anglo-Saxon case was most imperfect, which was a matter of some surprise, considering the great number of antiquities of this period which have come to light during the last twenty years. On the other hand, the Loan Museum was very rich in carvings in ivory, which formed perhaps the most interesting division of the whole collection, and in Limoges enamels of all periods. The collection of old glass was good, and all the branches of art of the later periods of the renaissance, and of the age which followed, were abundantly represented. Thus, in an historical point of view, in which consists the great importance of such a collection, the Loan Museum was tolerably complete; yet every one must have felt that its utility would have been greatly increased by a

little more historical arrangement, and if the visitor, in passing from one table or case to another, had been allowed to take the different classes of objects in something like their historical order, instead of jumping from new to old, and from old to new, until he lost all perception of the relations of the different classes to each other, he would, no doubt, have been benefited by it. Each class, too, might have been so arranged as to show the gradual development of the art which it represented. Thus, though we could not have started with art as it was cultivated by the uncivilized Britons, we might have traced it in its more barbaric form among the ancient Irish and the Anglo-Saxons, in the first development given to it by the earlier mediæval ecclesiastics, in the advance it made under the influence of Greece and Italy in the enamels, ivories, and illuminations of the twelfth and thirteenth centuries, till at length we come to the universal splendour of the renaissance.

It is curious to observe as we go on how slowly, and with what apparent difficulty, the purity of ancient art made itself felt in the mind of the mediæval artist. The love of elaborate ingenuity and showy display which had characterized mediæval art at the earliest period predominated throughout, and was never more strongly apparent than in the works of the renaissance, however excellent the execution of the details may have been. Art, like costume, had become an affair of fashion, and not of pure taste, so that it varied in forms and character from year to year, and in this chiefly consists the historical interest of such a museum of objects of the later periods. And amid all this extensive display, we cannot help being struck with the great absence of real beauty—it is all comparative, and in the whole collection we could select but few objects to recommend for imitation at the present day.

A SABELLA BUILDING ITS TUBE.

BY PHILIP HENRY GOSSE, F.R.S.

THE following particulars of a process of animal mechanics may possess interest for readers who study marine zoology under aquarian auspices, and I am not aware that they have been recorded before in detail. I give the *ipsissima verba* of my journal, written while the little mechanic was before my eyes. The account is an incidental testimony to the adequacy for aquarian purposes of the substitute for sea-water, the constituents of which I first made public in the *Annals of Nat. Hist.* for 1854:—

June 30. My large tank of artificial sea-water, made in

August last, is now very rich in animal life. The stones and old shells are clothed with a woolly down of (probably) *Ectocarpus*, and the whole has the settled, old appearance of a natural pool bottom. Among the inhabitants is a *Sabella*, which answers in all particulars to Montagu's *S. vesiculosa*, except that it is much shorter than his specimen, being about one and a-half inches long, and its tube, at least the free part, about two inches. The dark purple vesicles which he mentions at the tip of the gill filaments, are in mine much more conspicuous than represented in his figure, that of the anterior filament on each side being much larger than the rest, and forming a stout, globose, nearly black ball; the others diminish to about the twelfth on each side, where they disappear. These balls are placed on the inner or upper face of the filament stem, at the point where the pectination ceases, the stem itself being continued to a slender point beyond it—the "short hyaline appendage" of Montagu. From their great resemblance to the tentacled eyes of the Gasteropod mollusca, I have little doubt that these are organs of vision. If so, the profusion with which the Sabella is furnished in this respect may account for its excessive vigilance, which is so great that not only will the intervention of any substance between it and the light cause it to retire, but very frequently it will dart back into its tube almost as soon as I enter the room, even while I am ten feet distant.

This morning I found my Sabella clean out of his tube, and lying on the muddy bottom below. I was afraid he was moribund; but he was actively wriggling, and his beautiful disk blossomed as widely as usual, though grovelling on the sand. Some six hours elapsed, when I perceived that his body was no longer naked, but enveloped in a new, loosely-constructed, but rather tightly-fitting tube, from the posterior part of which the naked tail was protruding, as yet unprotected. It was evident that the Sabella was meeting the emergency of his situation by forming a new dwelling, and that he had commenced, though unseen by me, by making a ring of mud cemented with a gummy secretion around the neck, which ring, as it increased in length, was continually pushed farther and farther downwards towards the tail.

The process of natural manufacture is always interesting. I removed my artificer from the tank, and put him alone into an ample cell of glass with parallel sides, giving him plenty of water, and a bottom of sand, on which I allowed to fall through the water a little clay, rubbed to a paste between my fingers in the water. As soon as the turbidity had a little subsided, so that I could use a lens, I had the gratification of seeing how he proceeded.

In order to make this intelligible, I must briefly describe the structure of the parts engaged. All that is ordinarily seen of the animal is a flower-like disk protruding from the tube. This disk is composed of two semicircular fans (the gills), the pair forming a complete circle, except that the points of junction, behind and in front, are marked by a slight opening. Each fan consists of twenty-one feathers, regularly radiating, and curling outwards with a beautiful turning-over of the tip, so that the whole disk bears the closest resemblance to a trumpet-shaped flower. The filaments, which I have called *feathers*, consist each of a slender stem, beset on the sides with two rows of beards (*pinnæ*), whose direction is upwards and outwards from the stem, so as to make a groove, of which the face of the stem is the bottom. The beards are in constant active motion, some being thrown inwards every instant, striking, and as it were feeling, the water, every one quite independently, moved by an impulse of its own. Under a high power (500 diam.) all the beards and the exterior face of the stem also, are seen to be clothed with minute, but rapidly vibrating, cilia.

In the centre of the flower-like disk is the mouth, which is guarded by a pair of little pointed tentacles, and on the outside of the disk, at the base, there runs round a thin, fleshy, very flexible collar of membrane, which, at the posterior opening of the fans, or that which is opposite to the two principal eyes, is produced into a pair of moveable, soft, tactile flaps, which turn outward, and hang over the edge of the tube in course of house building.

All this being premised, and the workman's tools being thus described, let us see how he works with them. Suppose him to be lying along on the bottom, near one corner of the square glass vessel, so that through one side a lens can be brought to bear on one side of the animal, and through the other on the disk.

We first glance at the disk, taking a front view of the creature. The filaments of the gill-fans are so active, bending inward and outward, and perpetually crossing one another, and the pinnæ are jerking hither and thither so incessantly, that we are for a while confused, and can make out nothing. We must fix our eye on some individual filament, and watch that, heedless of all the rest. Now we perceive that the tip of this is bent over outwardly, until the inner face of it is in contact with the bottom, the pinnæ expanding over the clay like the legs of the letter A. In an instant these close together, seizing, as with so many opposed fingers, a little of the soft and impalpable clay, and at the same instant the filament is straightened from its recurved condition, and we perceive a

minute pellet of clay lying between the pinnæ. The pellet takes a lengthened form, and presently glides quickly and equally along the groove of the pinnated filament towards the mouth, carried along by means of the cilia with which every part is clothed. Glancing at other filaments on each side, we see a similar pellet in each—at least, of those which, as the disk lies, are in contact with the bottom. As we follow the tiny mud pellets to their destination, we trace them to the mouth, where the two pointed tentacles stand guarding the entrance; these appear to guide the united pellets to the posterior orifice between the fans, through which we see the lump making its exit.

"We can learn nothing more of its progress from this point of view; but let us now direct our lens to the side of the animal. Here we again see the soft lump emerging between the fans, and as it progresses, the moveable fleshy flaps above described receive it, and guide it to the edge of the tube, plastering it as if with trowels on the edge, regulating its thickness, and smoothing it down. Meanwhile, the animal slowly revolves on its long axis, by which means all of the filaments in turn are brought within reach of the ground, and thus the labour of feeding the trowels is fairly distributed, and, also, the deposit is made in succession upon every part of the edge of the tube.

The tube increases in length by means of this process with considerable rapidity, and it is not long before the animal is once more completely protected. Probably, as the desertion of the old tube was in this case voluntary, it is not unreasonable to infer that the formation of a new habitation is normal, and takes place at certain, probably irregular, intervals, through life. There seems to be an inner layer of gummy matter secreted from the collar, on which the mud pellets are moulded; and often the lower portion of the tube—the first formed—is found in this genus of worms firmly adherent to a stone, and consisting almost wholly of this gummy matter without any mud coating. The substance, which hardens in water, and is insoluble, is of a horny texture and colour, a pellucid yellowish brown, and is probably composed of chitine. Perhaps in the case before me, if the animal had been reposing on a stone, instead of soft mud and sand, the first-formed portion of the tube would have been adherent.

I add Montagu's description (slightly condensed) of the species, the accuracy of which is proved by my specimen:—"*Sabella vesiculosa.* Body with many segments, pale, dull orange, minutely speckled with white. . . . . Tentacles [gill fans] two, with about twenty-eight long ciliated fibres each, olive green, mottled with gray, partly in bands when

expanded; not forming a circle, but sub-convolute, the under part turning inward. At the points of each ray is a dark purplish vesicle, most conspicuous on the anterior ray of each plume, terminated by a short hyaline appendage. Mouth gaping; lips whitish, with two slender cirri; behind the tentacles a scolloped membrane surrounding the anterior end of the animal. Length six or seven inches. Tube coriaceous, but always coated with coarse sand and shells, ten or twelve inches in length."

DE CANDOLLE ON DARWIN'S THEORY.

THE *Archives des Sciences* has published some elaborate papers on the "Study of Species, on the occasion of a Revision of the Cupuliferæ,"* by M. Alphonse de Candolle; and in one, which appears in No. 60 of that journal, we find the following important remarks:—

"I shall take this occasion to speak of the system of Mr. Charles Darwin, the most modern, and at the same time the most ingenious and complete, of the systems founded upon the evolutions of organized beings in the course of time.

"The progress of geology having demonstrated the antiquity of organized beings in terrestrial strata, and a succession of forms, according to sufficiently regular laws, it necessarily happened that the idea of a successive derivation of forms from other forms older than themselves should acquire new favour. The triumph of the system of the epigenesis† of organs conducted to it by analogy, and the recent experiments which have once more rolled back the theory of spontaneous generation, augmented the inevitable tendency of naturalists towards the doctrine of evolution. In fact, if we had been certain that inorganic bodies were transformed to-day and under our eyes into organized beings, it would appear quite plainly that at certain epochs, and even frequently, the same thing must have happened. But precisely the contrary is demonstrated, and it is therefore probable that formerly, as now, forms have been changed by evolution from forms which previously existed.

* "Cupuliferæ (*cupula*, a little cup, and *fero*, to bear) the nut tribe. A natural order of Dicotyledons."—Henslow's *Dict. Bot. Terms.* A wide significance must be given to the word nut.

† "According to the doctrine of *epigenesis* no tissue, no organ pre-existed before its appearance; all are formed successively on the spot, and, so to speak, in all their parts. The individual nature of each animal rules and determines their composition and form. The theory of *evolution*, on the contrary, affirms that the germ contains in advance all the parts of the future being."—Quatrefages' *Metamorphoses de l'Homme et des Animaux*, p. 52.

"The difficulty is not to prove that, from one generation to another, changes of forms, sometimes considerable, may occur, as monstrosities, and many less striking anomalies, show this day by day. I assume, in fact, that a botanist somewhat accustomed to search for monstrosities, might find at least one example every day in the country; so that a thousand botanists might each year discover at least 365,000 monstrous growths. Small anomalies are frequent, and a complete similitude between two consecutive generations is rarer than monstrosities that are very distinct. Thus there arise under our eyes, without any intervention of man, and by operation of causes which we do not know, a very great number of forms, and of forms which are often so distinct that we should arrange them under new genera, and even under new families if they were persistent. Suppose that in Europe a single new specific form became prominent each year, a single new generic form once in ten years, and a single family form once in a hundred years, the European Flora would experience a greater change in a thousand years than in passing from the Miocene to the Pliocene, from the Pliocene to the Diluvium, etc.

"Thus the real difficulty is not the production of new forms, but in proving that the more or less aberrant forms that frequently arise propagate and preserve their peculiarity from time to time, so as to constitute, in the midst of ancient forms, new forms which are permanently hereditary. Mr. Darwin has placed his finger upon the essential point of this question in seeking a cause by which the variations from one generation to another necessarily become fixed, instead of disappearing according to the known laws of ancestry, by reason of fecundations imparted by individuals of the old form, or by an impossibility of nutrition, or by structural impotence to produce offspring. He considers he has discovered this cause in a 'natural selection' of forms which are most robust and best adapted to the external circumstances amongst which they arise, made at the expense of forms that are weaker, and whose adaptation gives them less resisting power. He lavishes, in support of his theory, accumulated observations, delicate and exact, on the habits of species belonging to both kingdoms, and on the complicated correlations which exist between individuals and varieties, and between vegetables and animals. He insists, more than was previously done, on the incessant struggle between organized beings, which limits their numbers in spite of boundless means of reproduction. It is here that he is most strong. He shows how the theory of evolutions is required to explain certain problems otherwise insoluble; for example, the existence of rudimentary organs, either useless or inconvenient for the individual, but which might have been useful to the

ancestors from whom they were inherited; the absence of certain species from countries so well fitted to them that they prosper when taken there, such as the horse in America, and the Erigeron Canadensis in Europe; the resemblance between the organized beings of one epoch, and those of an anterior epoch in the same part of the world: a certain uniform march which is observed in the succession of organized beings; and finally, the habitual juxtaposition of analogous species, that is to say, of the same genus, or division of a genus, in the same region, their frequent parcelling out (*cantonnement*) each in an island of the same archipelago, and the fact that they are not distributed throughout those countries which have now, and had at a former time, the same climate.

"The probability of a theory of evolution especially strikes those who do not believe in spontaneous generation, and who repudiate the idea that a blind or capricious creative force gave useless rudimentary teats to the males of the mammalia; appended to certain birds wings incapable of flight; supplied the bee with a dart, the employment of which causes her decease; furnished the poppy, and many of the Campanula tribe, with a capsule, whose dehiscence* occurs near the summit, and renders dispersion difficult; which added a downy tuft to the sterile seeds of many of the Compositæ, and denied it to fertile seeds, or only gave them a plume which fell off the seed instead of serving for its transportation. All these singularities—let us be plain, these defects—appear repugnant and embarrassing in the theory of a direct creation of forms such as we see them now, or as they existed at the Triassic or the Miocene† epoch; but it is quite otherwise with the theory of evolution. These inutilities or defects then assume the aspect of a heritage from ancestors who profited by them in consequence of a difference in their organization and surroundings. When an inherited peculiarity has become useless or mischievous, the species bearing it becomes extinct. Their original organization made them prosper in former time, it now causes their decline; just as certain great qualities in a people, or certain natural advantages which ministered to their interests in days of yore, sometimes become useless, or even so mischievous as to occasion their decay. The anomalies return under the dominion of a great law, and I find it natural that men whose ideas are far removed from materialism, such as Dr. Hooker, Asa Gray, and

* "Dehiscence (*dehisco*, to gape), the manner in which an organ, closed at first, ultimately bursts; but more especially applied when the bursting is with regularity along particular lines of suture, as in the anthers for the discharge of pollen; in many pericarps for the escape of seed."—Henslow's *Dict. Bot. Terms.*

† Trias is the name given by continental geologists to the New Red Sandstone series. Miocene is the middle Tertiary period.

Professor Heer, should prefer the theory of evolution, and attach themselves to studies that demonstrate its force.

"We must always distinguish the theory itself from demonstrations and deductions by means of which it is sought to establish it, and it is here that many naturalists, admiring the sagacity of Mr. Darwin, and the grandeur of his ideas, diverge from, or hesitate to follow him. If the theory of evolution be regarded as an hypothesis designed to explain important facts which do not admit of other elucidation, it seems to me eminently desirable, and it essentially takes account of the most obscure facts of natural history and palæontology; but on examining the proofs adduced in its support, even the very varied and ingenious ones of Mr. Darwin, I find them insufficient, and often contestable. Perhaps it may be said that grand hypotheses are considered realities in physics, although destitute of direct proof, on the ground that they explain all the facts that are known. Nevertheless, proofs are sought for, wished for, and discussed when produced. To this end physicists devise experiments, and make calculations; and naturalists, who cannot create living beings, nor perceive the origin of things, whether infinitely small or infinitely ancient, ought to observe facts, compare and weigh in their minds the value of indications and arguments of the most varied kind.

"Mr. Darwin's opinion, that a necessary and natural selection of the forms and qualities of individuals brings about a succession of different individuals in the lapse of time, is one of those new ideas which change the current of thought, because it assuredly has much truth in it and a considerable importance. The question is to learn whether there are other causes acting in an opposite direction, which Mr. Darwin may have neglected or underrated. He speaks, indeed, of ancestry, and of the breeding of ancient and numerous individuals with new and modified individuals, as leading back to pre-existent forms, but perhaps he does not assign to these influences all their power. Mr. Darwin, moreover, agrees that useful modification of species are rare, while many others are useless, and consequently transitory. One might object that, by a known law of the balance of organs and functions, when a useful modification exists in one direction, an opposite modification is developed elsewhere. Thus, one race of animals in which fat is caused to preponderate becomes unfit for reproduction. English horses, which are very swift in the race, cannot live in the open air of a rigorous climate; most of the vegetables, whose production of sugar or starch is forced, do not flower, as we see with the sugar-cane, or they contract diseases like the potato. Similar incidents probably affect wild species, but I do not insist upon them, fearing the reproach which has been directed against Mr. Darwin, that

he has too often drawn conclusions as to what must happen in nature from what does happen in domestication.

"We must agree with Mr. Darwin, whose frankness gives a pervading charm to his writings, that successive modifications of species by natural relation must be excessively slow, so much so, that for many thousands of years it would be impossible to perceive them. Practically, within historical periods we perceive nothing of it; on the contrary, a stability of form in certain species, and a constant susceptibility in regard to temperature, is demonstrated to have existed for three thousand years. The races of men instruct us on this matter. Assuredly, from the time of the ancient Hebrews, Greeks, and Romans, men of the white race have struggled with each other, both individually and collectively. The weakest, physically or intellectually, have always been at a disadvantage, while the strongest, physically and morally, have always carried the day; and yet we cannot say that, either in intelligence, beauty, strength, or health, there is any evident difference between the moderns and the ancients. . . . . Among modern societies, on which statistics have thrown great light, families and populations which receive the most intellectual culture become extinct faster than others,* and an excessive physical development has other pernicious effects. Thus the law of *balance*, of which I spoke, conducts to a sort of mean, in spite of successive acts of natural selection, whose existence I do not contest.

"The effect must be of indefinite slowness, as Mr. Darwin shows, and being controlled by other causes, often exceedingly active, its slowness is irregular. To this I have nothing to object, although the consideration of very prolonged periods of time makes varied impressions upon different minds. Not only does the idea of the infinite terrify us, as dominating a region which our mind cannot reach, but each one feels troubled when mention is made of durations which he is not accustomed to contemplate. A man without intellectural culture and historical knowledge finds his imagination confounded by a few hundred years; a few thousands produce the same effect upon an educated man to whom certain sciences are unknown, and millions are required to astonish the physicist or the geologist.

"The theory of evolution, and especially the Darwinian hypothesis, demands millions of years. We recoil, more or less alarmed, and reason justifies our instinctive fears. It tells us, in fact, that natural causes which man never witnessed, and which have no existence in his traditions, might have acted in

* We do not know where M. de Candolle finds statistics to show that the duration of life is shortest among the cultivated nations, or among their most educated classes.

very remote times in a manner which is unknown. Timidity is prudence in such a case."

The preceding extract from M. de Candolle suggests some important grounds of controversy with its author, but our object is to let him speak rather than to talk ourselves; and we lay it before our readers as an interesting contribution to those discussions which arise in all intelligent circles, and which every educated man carries on in the recesses of his own mind.

"PARASITE LARVÆ."

BY T. SPENCER COBBOLD, M.D., F.L.S.,

Lecturer on Comparative Anatomy, Zoology, and Botany, at the Middlesex Hospital Medical College.

MANY persons entertain erroneous notions respecting the habits and economy of those interesting creatures called tape-worms. A first attempt to look at them is often attended with a sensation of horror, whilst the act of handling them is seldom accomplished without a secret feeling of alarm. All this is very natural, and the mere idea of an animal, three or four times as long as the human body, taking up its residence within our own intestines is, certainly, not a very refreshing consideration; no, not even when it is accompanied with the kindly assurance of some benevolent friend that "it is for our good." At all events, we invariably feel justified in ridding ourselves of the unwelcome guest, and it deeply concerns us to know how we may effectually bar him out in future.

If the object of the present communication were to explain the very simple means by which we may avoid acting the part of "host" to the common full-grown tape-worm, we should have no difficulty in satisfying inquiries on this score; but, well knowing how much more obnoxious to animal life and comfort are the larval parasites referable to these same tape-worms or cestode entozoa, we deem it prudent to shelve, for the present, our consideration of the former, in order to throw light upon the structure, habits, and economy of the latter.

The cestode larvæ are much more common in occurrence than is usually supposed, and *they frequently cause death to man and the lower animals.* Here is our general proposition, the truth of which will be abundantly proven in the sequel; but, in the meanwhile, by way of introduction, we invite attention to the organization of a comparatively harmless larva which developes itself in the salt-water fishes.

Sharks and skates are copiously infested with tape-worms of

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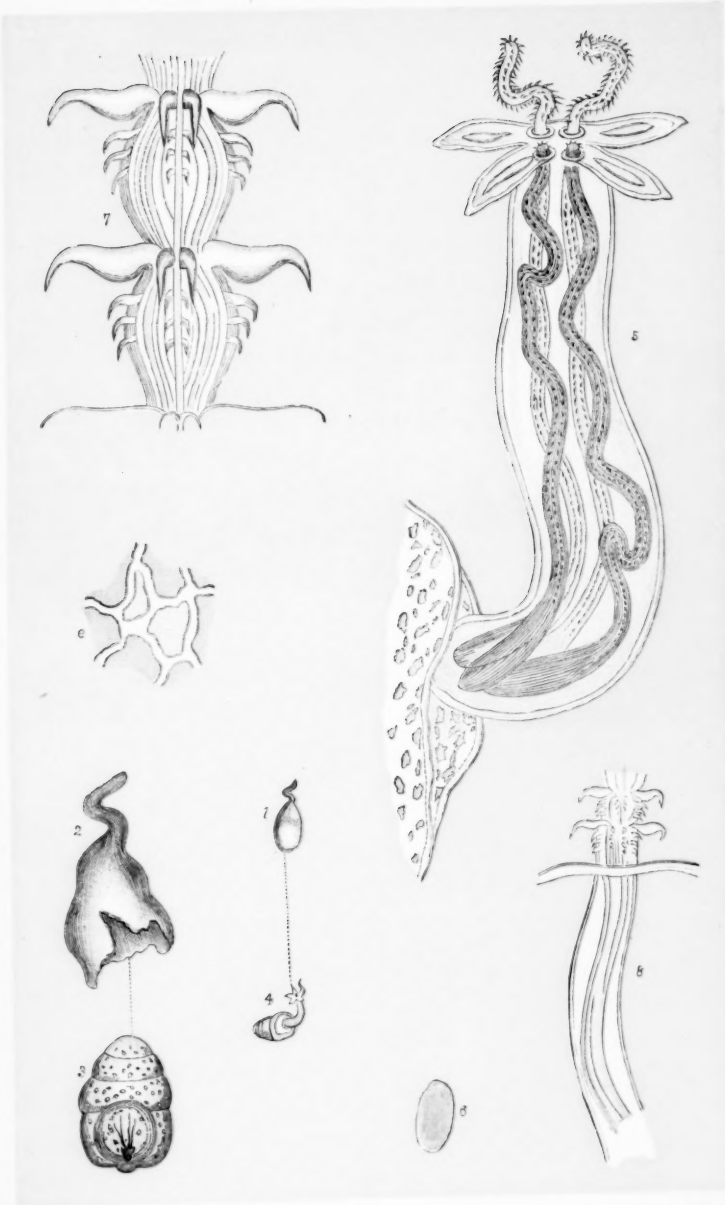
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a peculiar construction, and to such cestodes the illustrious parasitologist Rudolphi applied the generic title of *Rhyncobothrium*. These rhyncobothria are now known to be mature tape-worms, whose larvæ had been previously regarded as distinct species under the generic title of *Tetrarhynchus*. For simplicity's sake we retain the latter title in place of the former, having already employed this title when describing a remarkable example of sexually immature tetrarhynchus in former pages of the INTELLECTUAL OBSERVER (vol. 2, p. 82). We shall also make use of Prof. Van Beneden's term "scolex" to specialise those larvæ, the heads of which resemble those of the adult or parent form. These scolices, then, are merely larval tape-worms, those belonging to the genus tetrarhynchus being particularly abundant in marine fishes, such as the cod, haddock, turbot, sole, and flounder; they are likewise found in the mackerel, mullet, gurnard, conger, sun-fish, and even, according to Von Siebold, in the cephalopodous molluscs or cuttle-fishes.

The accompanying plate illustration represents a scolex of tetrarhynchus removed from the wall of the intestine of a common haddock. It was associated with several other larvæ of the same kind, varying in size from a pin's head to that of a pea. Each young tetrarhynch was enclosed in a thick-walled sac, such as is displayed in figs. 1 and 2, the latter representing the sac burst open, and magnified four diameters linear. Fig. 3 gives a general view of the scolex, which is inverted and enclosed within the bladder-like vesicle—the latter being, in point of fact, the tail. The four long filamentary proboscides are also seen here, and also the little highly-refracting dots, which represent what are termed "calcareous corpuscles." The transverse lines are caused by the regular folding of the vesicles. Fig. 4 shows the head and neck of the natural size, everted. Fig. 5 is another view of the anterior end of the same, amplified about twenty diameters. It exhibits four narrow, pointed, sucking appendages, at the base of each of which is an open papilla, giving passage to one of the retractile proboscides or tentacles. These organs are armed with a complicated series of spines or hooks, but whilst lodged within the neck are embraced by a strong tubular and muscular sheath, which at the lower part is club-shaped, so as to form what has been termed the "lemniscus;" the figure (5) also shows a portion of the large caudal vesicle, with the calcareous corpuscles *in situ*. Fig. 5*a* represents a small portion of the wall of the neck, displaying a fine network of capillary tubes beneath the skin (× 260 diam.). Fig. 6 is an isolated sclerous or calcareous particle greatly enlarged; fig. 7 being a section of one of the retractile proboscides, showing the relative size and disposition

of the hooks (× 200 diam.). The retractor muscle of the proboscis is represented in fig. 8. From these facts it will be seen that each proboscis is, as it were, composed of numerous spurious segments, every division supporting quadruple rows of four hooks, sixteen in all, the superior set being disproportionately large; so that, in any one individual scolex, the total number of spines must amount to several thousand. These organs are employed as instruments for boring through the flesh and tissues of the host, the larvæ being thus furnished, as it were, with four chain saws, whose efficiency and adaptiveness is greatly increased by the circumstance that each chain presents four serrated edges, the teeth of which are, moreover, of four different sizes. Such an arrangement as this is sufficient to excite our astonishment. Not a few tetrarhynchi exhibit even a still more complex armature of the proboscides, as may be seen, for example, in the *T. longicollis*, infesting the tope or penny-dogfish (*Galeus vulgaris*). This, and many other closely-allied cestodes, are beautifully figured by Van Beneden in his *Recherches sur les vers Cestoides.*

From what has thus been advanced concerning the prevalence and variety of these scolices in marine fishes, it will at once be conjectured that the sharks and rays—whose diet does not appear to be restricted to one or two particular fishes only—will be liable to infest themselves with a great variety of tape-worms. This conjecture is, indeed, entirely supported by ascertained facts; for we find the angel-fish (*Squatina Angelus*) infested by at least four different cestode species, whilst the common thornback (*Raia clavata*) rejoices in the distinguished honour of being permitted to entertain, as tolerably constant guests, no less than eight distinct forms of tape-worm, belonging to the genera *Onchobothrium, Tetrabothrium, Tetrarhynchus,* and *Tetrabothryorhynchus!*

All these mature tape-worms, however, as before hinted, are harmless occupants when compared with the cestode larvæ which some of their congeners produce. Possibly, the sun-fish may wince a little when his liver is being bored through and tunnelled by an immature *Tetrarhynchus reptans,* and the sharks and rays would, in all likelihood, feel more comfortable after taking a good vermifuge; but when a scolex of the common tape-worm (*Tænia solium*) gets into the human brain, we are in a far worse plight than our piscine friends,—in short, "it is all up with us." Seriously, it may be asked, do young tape-worms or scolices ever get into our heads; and, if they do, under what circumstances are they permitted to enter? In reply, we answer the former question affirmatively, but the easy solution of the latter must be allowed to stand over.

Several entozoologists, including the illustrious Rudolphi,

have found the scolex commonly known as the "pork meazle" (*Cysticercus telæ cellulosæ*) lodged in the human brain, whilst cases of its occurrence in the eye of man have been recorded by Soemmering, Cuvier, Larrey, Schott, Mackenzie, Rose, and many others. Occasionally, in instances where the scolex has caused death, such cases have been described, not only in the medical journals, but even in the public newspapers. Through the vigilance of a relative an example of the latter kind was not very long ago brought under our notice, and, as the case in question admirably illustrates the subject under consideration, we subjoin an abridged statement, omitting the *days* mentioned, as neither the monthly nor precise yearly date of its report is at present in our possession. The passage stood nearly as follows:—

Extraordinary Death from a Worm in the Brain.—An inquest was held at the Walsall Workhouse, before the coroner, Mr. Fletcher, on the body of Rachel Brady, twenty years of age, an inmate of the house, who was found dead in bed. On her admission she complained of pain in her head, and was treated for it by the medical officer, Dr. Burton. This gentleman, in giving evidence of the conditions he had discovered in course of making the *post mortem* examination, stated that in the *tuber ancillare*, at the top of the spinal marrow, there were four hydatid sacs or *cysticerci* (*telæ*) *cellulosæ*. These conditions, he considered, were sufficient to account for the suddenness of the death of the deceased, and he had ascertained that it was not uncommon for her, when alive, to eat sausages. He had no doubt the hydatid sac was composed of the egg of the tapeworm, the parasite having been taken into the body in the process of eating sausages not properly cooked; this food being prepared from measled pork. The jury returned a verdict of "Disease of the Brain."—*Staffordshire Advertiser.*

This case is very instructive, and we are privately informed by Dr. Burton that an account of it was also subsequently reported in one of the medical journals, the date of which he is unable to supply. The newspaper reporter is not quite correct in stating that "the sac was composed of the egg of the tapeworm," because helminthologists have satisfied themselves that these hydatid scolices are formed by the growth (and alteration in form and character) of the embryo after its escape from the egg. Under the microscope, the scolex or hydatid displays a head, neck, and vesicular *body*, improperly so called, as the latter sacciform portion is, strictly speaking, the caudal vesicle or tail.

In the accompanying cut we have an illustration of the same species of *Cysticercus*, taken from a specimen preserved in our collection. This individual scolex was found with several

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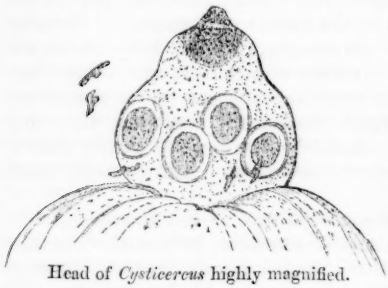
others snugly ensconced in the brain of a man whose death their combined presence served to occasion.

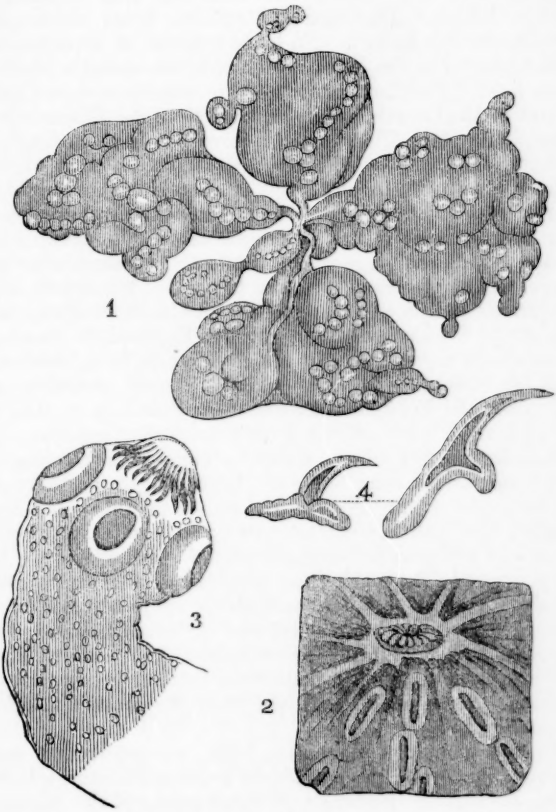
For possession of the specimen we are indebted to the kindness of J. W. Hulke, Esq., F.R.C.S., from whose notes of the case we gather that the poor fellow suffered from epileptic fits, the disease being entirely due, in this instance, to the presence of these scolices. If more examples of the kind were required, it would not be difficult to produce them from the records of medical literature; and we may also mention that a third example of *Cysticercus telæ Cellulosæ* from the human brain was some time ago presented to the Hunterian Museum of the Royal College of Surgeons. Whatever their frequency in occurrence, it is quite clear that when the scolices have once settled down in our brains, all attempts to get rid of them—even if we knew that they were there—must prove futile. Unfortunately, too, other kinds of scolex are liable to play the same disastrous tricks with us, even in the brain, so that although we may escape death by the invasion of *Cysticercus*, we may nevertheless fall a prey to the wiles of the more abundant *Echinococcus*. Alas! for the dignity of human nature, we succumb to the self-seeking propensities of a larval parasite, whose body is barely visible to the naked eye.



Head of *Cysticercus* highly magnified.

We now pass to the consideration of a larval tape-worm which occasioned the death of a Madagascar Lemur (*L. maco*), formerly living in the Zoological Society's menagerie, Regent's Park. This scolex, by examining the figures given in the annexed cut, will be found to differ, not only from those already described, but also from all other known forms of parasite larvæ. Its nearest ally is the well-known hydatid (*Cœnurus cerebralis*) which infests the brain of sheep, giving rise to the formidable and occasionally fatal disease known as the "staggers." In fact, we have here a second kind of *Cœnurus*, in which, as in the common species, the scolices are associated in a colony, but, instead of occurring as separate and independent cysts, each supporting numerous tape-worm heads, we find the *Cœnurus* of the Lemur forming several cysts connected by narrow peduncles (fig. 1). The hydatids from the Lemur were not found in the brain, but occurred in such numbers in the liver and on both sides of the thorax, that they proved as destructive to the life of the host as if they had infested the cere-

bral organ. Those in the chest were connected to the lining membrane of the lungs, forming semi-transparent pedunculated cysts, split up, as it were, into numerous lobules, the entire mass being connected to the extremely atrophied lungs by short pedicles. Here and there small colonies, consisting of



COLONY OF CŒNURUS FROM A LEMUR.

one or two vesicles only, were seen in process of development. Each lobulated cyst presented a variable number of small round papillary elevations, which in some places assumed a regular linear arrangement. Under a low magnifier the surfaces of the papillæ exhibited a central oval depression externally (fig. 2), and in the fully developed condition they were found to con-

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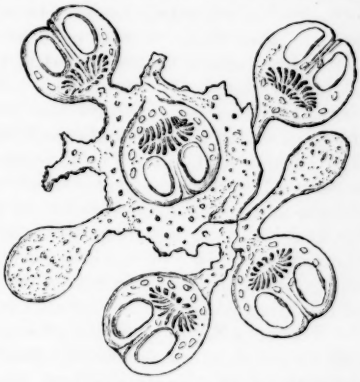
tain perfect tape-worm heads. Each cyst or hydatid is, therefore, to be regarded as a compound scolex, every individual head of the colony representing an immature cestode, with its four characteristic suckers, central proboscis, and double crown of hooks (fig. 3; × 40 diam.). The two rows of the latter, sixteen to the row, present the usual disparity of size, their manifest differences, in bulk and outline, being shown in fig. 4 (× about 250 diam.). No loose scolices, or separate heads, could be found in the cysts, which only contained a clear pale-yellow fluid. This last-mentioned circumstance shows that the hydatid of the Lemur is quite distinct from the *Echinococcus*, although in its place of residence it corresponds more closely with the latter than it does with *Cœnurus*. As yet we are ignorant of the adult *Tænia*, to which this curious larva is referable.

The next larval parasite which naturally demands our consideration is, in so far as it affects our welfare, the most important of all the tape-worm scolices. Disastrous as are its ravages amongst various animals, to none of these does it prove so injurious as it does to our fellow-creatures dwelling in Iceland, whilst even amongst ourselves in England its death-dealing invasions are not unfelt. In Iceland it is calculated that about one-seventh of the population who die annually, perish solely from the Echinococcus disease. Startling as this result may appear, it only affords a very imperfect estimate of the actual mischief this minute scolex is capable of effecting. For some time past, helminthologists have sought to discover the best methods of checking the prevalence of this much-dreaded malady; but although we are pretty well acquainted with the migrations and genetic changes of the species, we are hardly in a position to do more than suggest a partially preventive remedy. A great variety of animals are subject to Echinococcus disease, but we can only select one or two examples, for the purposes of illustration. The literature of the subject is also of immense extent; the last important memoir being that of Dr. Naunyn, in Reichert and Du Bois Reymond's *Archiv* for November, 1862.

In the month of February, 1861, we received a mass of Echinococcus cysts, procured from a second Lemur, which died at the Zoological Gardens. A small group of the scolices, or heads, are here represented (× 130 diam.). If these little scolices be closely examined, they will not be found to differ materially from those occurring more frequently in our domesticated animals, nor, indeed, have we been able to discover any essential difference between them and the *Echinococci* infesting the human body. Kuchenmeister, we are aware, thought he had made out two distinct forms, but Professor Leuckart, of Giessen, has satisfactorily demonstrated the erro-

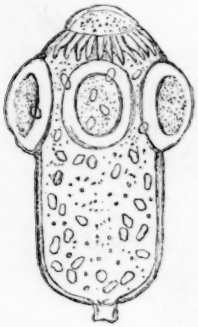
neousness of Kuchenmeister's views. Moreover, on continuing the investigation, we have satisfied ourselves that the two reputedly distinct forms are identical. In the group here figured all the perfectly developed scolices have their heads invaginated within their own bodies, the crowns of hooks and the suckers being for the most part viewed in profile. The calcareous corpuscles are distinguishable from the ordinary granules of the endocyst (from which the scolices bud) by their comparatively large and more uniform size. Two of the pedunculated buds are imperfectly developed.



Brood of *Echinococcus:* Lemur.

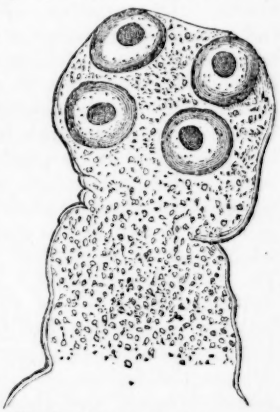
As already stated, the Echinococcus disease occurs in this country; but in the Registrar's Reports one never sees any statement as to the number of persons who die of parasitic disease. Of course not. Many cases are altogether overlooked, and even in those which are taken notice of, the death is attributed either to a "disease of the brain," or of the liver or lungs, as the case may be, although these organs may be altogether free from any structural disorganization, apart from that immediately occasioned by the mechanical pressure in the neighbourhood of the Entozoon. Instances of the kind have come under our notice, as, for example, in the case, ably reported in the *Lancet* for November 1st, 1862, where a poor girl died in one of our metropolitan hospitals from *Echinococci*, which had taken up their abode in her liver; and, as also in Dr. J. Risdon Bennett's case (given at p. 5 in the recently published 13th vol. of the *Pathological Transactions*), where another person perished from *Echinococcus* which infested the brain. Annexed is a figure of one of the scolices from a liver-cyst in the former case; and in all essential points it will be found to agree with those figured from the Lemur. In this case, however, the head is everted, so as to display the four suckers (× 260 diam.). Of course the medical profession know very well that such cases as the above are referable to Entozootic disease, but the public are very ill-informed, if not altogether ignorant, of the prevalence and destructive powers of the Entozoa. It may be thought unkind to dispel that "ignorance which is bliss," but unless some person duly conversant

with these parasites be instructed to report upon them, not a few more men and animals will continue to perish, several of which might probably have been saved by preventive remedies. Our experimental investigations into the development and migrations of these creatures are not unattended with personal risk, though that risk is doubtless far less apparent than that of the intrepid voyager who, in the interests of science and humanity, leaves the earthly globe six miles behind.



Human *Echinococcus.*

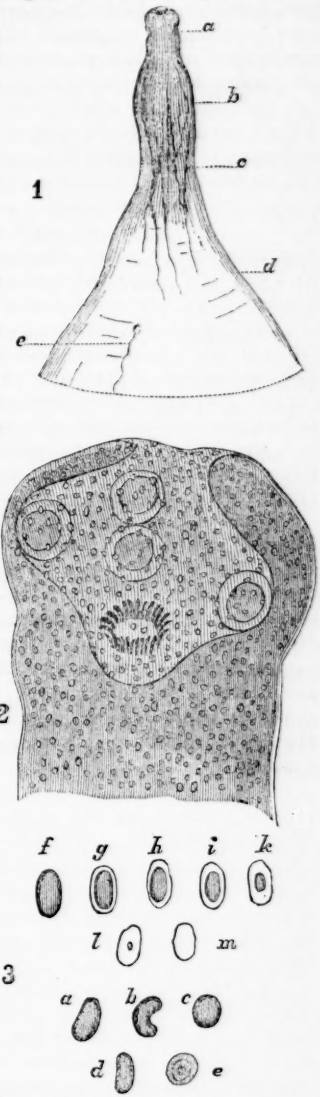
Another larval parasite of considerable interest is that occurring in veal or beef, and which, when swallowed by ourselves, will give rise to a tape-worm, delighting to embrace the favourable opportunity of residing within our intestines. The cestode in question (*Tænia mediocanellata*) is not the common tape-worm, but is one very frequently mistaken for it, and is, in all likelihood, not much less abundant. Its discovery in the adult condition as a distinct species is due to Dr. Kuchenmeister, but for our knowledge of the larval state we are principally indebted to Prof. Leuckart, of Giessen. The head and neck of this *Cysticercus* (or scolex of the *Tænia mediocanellata*) is represented in the accompanying cut (× 30 diam.), from a specimen presented to the writer by the distinguished helminthologist last named. The scolex is about twelve weeks old, that is to say, it was artificially bred in a calf, from the eggs of a tape-worm, given with food to that animal twelve weeks previously. The adult cestode or tape-worm is readily distinguished from the common *Tænia solium* by its not possessing any crown of hooks, and by other characters only a little less conspicuous.



Head of *Cysticercus* from a Calf.

The last larva to which we invite attention is the well-known hydatid of the caul (*Cysticercus tenuicollis*). This scolex not only infests our domestic cattle, but it has also been found in man, and in various wild animals. It is the juvenile condition of a tape-worm (*Tænia marginata*) living in the intestines of the dog. The scolex here figured was

taken from a female Red River hog (*Potamochœrus penicillatus*) which died at the Zoological Society's Gardens. There were, indeed, five specimens, all of which exhibited a more or less oval outline. Fig. 1 shows only the neck (*a*), the body (*b*), numerous rope-like coils hanging within from the inverted head (at *c*), a portion of the enormously-developed caudal vesicle (*d*), and a small thread-like filament suspended from the inner surface of the latter (at *e*). The head itself, being lodged within the upper part of the neck, was only detected by careful dissection, and when placed under an inch objective was found to display the usual four sucking disks, surmounted by a coronet of hooks (fig. 2). The margin of the neck was bordered by a double contour, the parenchymatous substance being everywhere studded with a multitude of calcareous corpuscles, the latter not being limited to the neck, but existing also in the head. These so-termed calcareous, or, as we prefer to call them, "sclerous," corpuscles from this *Cysticercus ex Potamochœro penicillato* were examined with especial care. When viewed with transmitted light, they impart to the tissues a dark pigment-like hue, which is merely owing to the shadows caused by their highly refracting properties. They were much more numerous than the accompanying figure (2) indicates, for, indeed, it would be almost impossible to represent their numbers in a drawing, without imparting to the illustration a very



CYSTICERCUS TENUICOLLIS.

confused appearance. Their general disposition and relative size, however, is fairly indicated, and (in fig. 3) some of them have been highly magnified (220 diams.) Their form is commonly that of spherical, or oval, flattened disks (*f, c, e,*); but not unfrequently they are elongated, occasionally thicker at one end than the other (*a, d*), and sometimes reniform (*b*). All are bordered by an opaque margin; and they often display evidences of concentric lamination, the rings resembling nuclei and nucleoli (*e*). In respect of size they do not vary materially, having an average length of $\frac{1}{1400}$ to $\frac{1}{1000}$, and a breadth of from $\frac{1}{2000}$ to $\frac{1}{1400}$ of an inch. On the addition of diluted sulphuric acid, a rapid effervescence took place, accompanied with the total destruction of the corpuscles; but the alkaline reagent (*liquor potasse*) caused only a gradual dissolution of the enveloping membrane, leaving behind a perfectly transparent and thin calcareous plate, unpossessed of any appreciable light-refracting properties. The last-mentioned change proceeded uniformly from without inwards; the corpuscle (*f*) presenting in succession the appearances indicated (at *g, h, i, k, l,* and *m*) in the figure; the last (*m*) is the isolated calcareous plate, whose circumferential border has lost that entire smooth outline which the unaltered corpuscle invariably exhibits.

Limitation of space forbids our entering upon the curious question still raised in respect of the function of these bodies; but on the whole it may be said that Von Siebold's idea (that they are analogous to the "spicules and calcareous networks" strengthening the integument of Echinoderms) has gained a more general acceptance than any other theory. Those who desire further particulars on this point are invited to refer to the writer's previous paper, in the Zoological Society's Proceedings (Vol. XXIX, p. 93), and also, especially, to Prof. Huxley's memoir on Echinococcus in the same work, for the year 1852.

COMETS.

AN ACCOUNT OF ALL THE COMETS WHOSE ORBITS HAVE NOT BEEN CALCULATED.

BY G. CHAMBERS.

(*Continued from page* 383, *Vol.* ii.)

153. In February, a comet appeared in the W.—(De Mailal, ii. 571.)

147. A comet appeared in May in the North-west, and lasted three weeks.—(Ma-tuoan-lin; De Mailla, ii. 584.)

146. "After the death of Demetrius, King of Syria, the father of Demetrius and Antiochus, a little before the war in Achaia, there appeared a comet as large as the sun. Its disc was at first red and like fire, spreading sufficient light to dissipate the darkness of night; after a little its size diminished, its brilliancy became weakened, and at length it entirely disappeared."—(Seneca, *Quæst. Nat.* vii. 15.) It lasted thirty-two days.—(Jul. Obseq.)

137 [i.] "In the reign of Attala, a comet was seen which, small at first, afterwards became much larger. It reached the equinoxial circle, and equalled in length that part of the heavens which is called the Milky Way."—(Seneca, vii. 15.) From Ma-tuoan-lin's account it would seem more likely that this comet reached the Milky Way not by its length, but by its motion. It appeared in March.

137 [ii.] A comet appeared two months after the preceding, which passed from ε Herculis to α Lyræ.—(Ma-tuoan-lin.)

137 [iii.] A comet was seen in the autumn in the North-west.—(Ma-tuoan-lin; De Mailla, iii. 9.)

134. At the birth of Mithridates a comet appeared, and lasted seventy days; the heavens appeared all on fire; the comet occupied the fourth part of the sky, and its brilliancy was superior to that of the sun; it took four hours to rise, and the same to set.—(Justin. *Hist.* xxxvii. 2.) There is very great uncertainty about this comet of Mithridates, but Pingré, after considering Ma-tuoan-lin's account, is almost certain that 134 is the year. He also says that probably it appeared in the middle of July in the West; before the end of August it would have been lost for a few days in the sun's rays, when probably the P.P. took place. It would then have re-appeared with increased brilliancy early in September in the East, and so have passed away from the sun.—(*Comét.* i. 270, 578.)

127. A burning torch appeared in the heavens.—(Jul. Obseq.)

119. A comet was seen in China in the East.—(De Mailla, iii. 46.)

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118. When Mithridates ascended the throne, there appeared during sixty-six days a comet exactly resembling that which was seen at the birth of that monarch.—(Justin. xxxvii.) It came from the North-west in May.—(Ma-tuoan-lin.)

109 [i.] A comet was seen in the feet of Gemini in the month of June.—(Ma-tuoan-lin; De Mailla, ii.; 61.)

109 [ii.] This comet appeared contemporaneously with the preceding, in the constellation Ursa Major.—(Ma-tuoan-lin; De Mailla, ii. 61.)

108. A comet appeared in the region lying between Procyon (α Canis Minoris) and α and β Geminorum.—(Ma-tuoan-lin.)

102+. A comet was seen in China near γ Boötis.—(Ma-tuoan-lin.)

93. A torch appeared in the heavens.—(Jul. Obseq.)

91. A torch appeared in the heavens.—(Jul. Obseq.)

86. A comet was seen in autumn in the East.—(De Mailla, iii. 98; Plin. ii. 23.)

83. A comet was seen in the spring in the North-west.—(De Mailla, iii. 101.)

75. "In the Consulate of Cn. Octavius and C. Scribonius, a spark was seen to fall from a star; it grew larger as it approached the earth, and became equal in size to the moon, and gave as much light as the sun gives during the day time when the sky is entirely covered. In returning into the heavens it took the form of a *lampas* [torch.]"—(Plin. ii. 35.) This description may be fairly taken as applying to a comet, though the wording is very obscure.

62. A burning beam stretched from the Western horizon to the zenith.—(Jul. Obseq.) Torches ran from the West to the middle of the sky.—(Dion. Cass. *Hist. Roman.* xxxvii.) A comet appeared in the East in the 6th Moon.—(De Mailla, iii. 136.) Dion. Cassius's allusion is very doubtful; and whatever may be the date of the burning beam, it is probable that De Mailla's comet must be referred to 61.

55. A torch appeared which advanced from the South to the North.—(Dion. Cass. xxxix.)

52. A torch appeared which passed from the South to the East.—(Dion. Cass. xl.)

48. During the war between Cæsar and Pompey, "a comet (that terrible star which upsets the powers of the earth,) showed its portentous hair."—(Lucan, *Phars.* i. 526.) In the 3rd Moon a comet was seen near β Cassiopeiæ; passing by ι in that constellation it became lost in the circumpolar regions.—(De Mailla, iii. 155.)

43 [i.] A comet was seen in China in May—June, whose Right Ascension was the same as that of Orion.—(De Mailla,

iii. 162.) It came from the North-west, its tail was very long and pointed to the North-east.—(Ma-tuoan-lin.)

43 [ii.] A hairy star was seen for seven days under the Great Bear during the celebration of the Games given by the Emperor Augustus in honour of Venus. It rose at about five in the evening, was very brilliant, and was seen in all parts of the earth. The common people supposed that the star indicated the admission of the soul of Julius Cæsar into the ranks of the immortal gods.—(Suet. *Vit. Jul. Cæs.*) It was visible therefore from September 23 to September 29.

Dion. Cassius says that in addition to the comet which appeared contemporaneously with the emperor's games, there was seen a burning torch which traversed the heavens from East to West; and also an unknown star, which shone for many days.—(*Hist.* xlv. 17.) Pingré thinks the former was simply a meteor, but that the latter was that which was seen in China, and recorded as having been a comet.—(*Comét.* i. 278.)

42 or 41. Previous to the battle of Philippi, comets appeared.—(Virg. *Geor.* i. 488; Manilius, *Astron.* i. 904.)

31. A torch appeared in February for several days.—(Dion. Cass. l.; De Mailla, iii, 178; Ma-tuoan-lin.)

29. Before Egypt submitted to Augustus, there appeared comets.—(Dion. Cass. li.) Lubienitzki (a modern writer) says that a comet appeared for ninety-five days in Libra, but gives no authority.

4. At the Vernal Equinox a comet appeared for seventy days in the head of Capricornus.—(De Mailla, iii. 214.)

3. In April or May a comet appeared near *α* Aquilæ, to the north of Capricornus.—(De Mailla, iii. 214.) Probably the same as the preceding, but one year wrong in the date.

A.D. 10. Several comets visible at the same time.—(Manilius, i.; Dion. Cass. lvi. 24.) Some modern cometographers state that one appeared in Aries for thirty-two days.—(Lubienitzki.)

14. Hairy stars of the colour of blood.—(Dion. Cass. lvi, 29.) A comet was seen in China for twenty days, either at the end of 13 or the beginning of 14.—(De Mailla, iii. 240.)

19. A comet was seen in China.—(Couplet.)

22. A comet was seen for five days in December. It was in Hydra, and moved in a S.E. direction.—(De Mailla, iii. 251; Ma-tuoan-lin.)

39. A comet became visible on March 13 in the Pleiades; it moved in a N.W. direction through Aries, towards *α* and *β* Pegasi. It remained visible forty-nine days.—(De Mailla, iii. 326; Ma-tuoan-lin.)

54. A comet appeared for a long time, in the autumn (?) It was first seen in the N.; it moved to the zenith, and thence

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eastwards, and day by day its brilliancy diminished.—(Dion. Cass. lx. 35; Suet. *In. Claud.*)

55. A comet appeared in November 55, and remained visible for 16 weeks, or till March 56. When first seen it was 2° long; it moved towards the S.W., and disappeared on March, 26, 6° N.E. of γ, δ, η, θ Cancri.—(Gaubil.)

60. A comet, with a tail 2° long, appeared on August 9, to the N. of η, γ, a, and δ Persei. It remained visible for 19 weeks, and passing southward, disappeared S. of the feet of 326; Virgo.—(Tacitus, *Annal.* xiv. 22; De Mailla, iii. 352; Ma-tuoan-lin.)

61. On September 27, a strange star was detected to the N.W. of ρ Boötis, with a tail pointing towards Corona Borealis. After seventeen days it quitted this position, but we are not told whither it went.—(Ma-tuoan-lin; Seneca, vii. 28.) It is uncertain whether the comet seen in China is the same as one spoken of by Seneca.

64 (i.) On May 3, an extraordinary star, with a vapour 2° was seen to the S. of η Virginis, and lasted eleven weeks.—(Gaubil.)

64 (ii.) A comet appeared at the end of this year, in the reign of Nero, and lasted six months. It passed from the N through the W. to the S.—(Seneca, vii. 21, 29; Tacit. xv. 47 Suet. *In Nerone.*)

65. On July 29, a great star was observed near δ and η Hydræ; it approached a and γ Leonis, and passing a and γ Persei, arrived near β Leonis (?) The vapour extended to ι and κ Ursæ Majoris; it remained visible eight weeks.—(Ma-tuoan-lin.)

69. A comet appeared sometime between April and December.—(Dion. Cass. lxv. 8.) Possibly this may be the object referred to by Josephus as having been seen over Jerusalem before its destruction by Titus.—(*Bell. Jud.* vi. 5.)

70. A strange star appeared in the head of Leo in December 70 or January 71. It remained visible for seven weeks.—(Gaubil.)

71. On March 6, a comet appeared in the Pleiades; after eight weeks it was seen to the right of the head of Leo, and then vanished.—(Gaubil.)

75. On July 14, a comet was discovered in Hydra; moving to the south of Coma Berenicis, it passed to the vicinity of β Leonis.—(De Mailla, iii. 375.)

76. On September 7, a comet, with a tail 3° long, was seen between a Herculis and a Ophiuchi, whence it passed to Capricornus. It remained visible for six weeks, and travelled slowly.—(De Mailla, iii. 376; Ma-tuoan-lin; Pliny, ii. 22.)

77. On January 18, a comet, with a tail 8° or 9° long,

appeared in the R. A. of Aries, whence it moved to the tail of Draco. It remained visible for fifteen weeks.—(Ma-tuoan-lin; Gaubil.)

79. In the spring (?) a comet was visible for a long time, during the illness of Vespasian.—(Dion. Cass. lxvi. 17; Suet. *In Vesp.*)

84. On June 4, an extraordinary star 3' long appeared in the eastern heavens. Its R. A. was 8' greater than μ^2 Scorpii. It passed near *a* Cassiopeiæ into the circle of perpetual apparition, remaining visible six weeks.—(Hind.)

101. On December 30, a new star appeared in the head of Leo. As no mention is made of any change of position, it may have been merely a temporary star.—(Hind.)

104. On June 10, a new star appeared in the circumpolar regions; it passed to the Pleiades, and vanished in the next moon.—(Hind.)

VEGETABLE HYBRIDS.

In recommending that a memoir by M. Naudin, on the above subject, should receive the "grand prize for the physical sciences," the commission of the French Academy made the following interesting remarks on that gentleman's researches :—

"His conclusions tend to a profound modification of the ideas admitted by the majority of physiologists respecting the conditions which regulate the production of hybrids. The first and most important is, that the singular beings which result from the cross fecundation of two different types, far from being condemned to absolute sterility, are frequently endowed with the faculty of producing seed capable of germination. Out of from thirty-eight to forty hybrids of species obtained by M. Naudin, and described in his memoir, only nine, or possibly ten, appeared to be completely sterile. All the rest, forming three-quarters of the entire number, produced seeds which germinated perfectly. These fertile hybrids belonged to the genera Primula, Datura, Nicotiana, Petunia, Linaria, Luffa, Coccinea, and Cucumis. A serious objection might be raised against this conclusion, which is so little in harmony with the general belief introduced into science by Köhlreuter, and adopted by Knight, Klotzsch, etc., it is that the fecundity of the hybrids, obtained by the author, was due to the action of the pollen of one of their progenitors, and not to that furnished by themselves. But this objection breaks down before the important fact that the hybrids were isolated from their parents, and could only be fecun-

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dated by themselves. This fecundity of a great number of hybrids is exhibited in different degrees, but it is usually related to the proportion of normal pollen grains which the microscope discovers in the anthers of the plants.

"The second consequence of major interest which results from the numerous experiments described in the memoir, is that fecund hybrids have a tendency to return to the parent form, and that without any other action than the influence of their own pollen, in such circumstances that the pollen of their parents could not possibly operate upon them. If this principle be sufficiently established by our author—and it does not seem possible to consider otherwise in the presence of the numerous facts and conclusions upon which it rests—there can no longer be a question concerning those bold theories according to which the number of vegetable forms permanently transmissible by generation, that is to say, of species, may increase indefinitely from day to day by means of hybridation."

Upon this passage we may remark, that the *tendency* to return to the parental type is proved by the evidence of the facts, that in both the animal and vegetable worlds species have an undoubted persistance in time, although fertile hybrids are much more common than was formerly supposed. The French commission do not, however, seem disposed to avoid the logical error of premature generalization; and if their remarks are directed against Darwin's theory, we may remind them that its author does not, in the words of Sir C. Lyell, "regard hybridization as a cause of new species, but rather as tending to keep variation within bounds."

The members of the commission proceed to inquire whether the fecundity of hybrids is proportioned to the external resemblance of the species which produce them, and they tell us that the memoir replies, "in general, yes; but in exceptional cases, no. In fact, experiments with closely allied species, of Datura, Nicotiana, and Cucumis, have furnished examples in which mutual fecundation was difficult, or hybrids sterile; while, on the contrary, species botanically remote from each other have yielded very fertile hybrids with remarkable facility."

"Lastly, a fourth question relates to the organ which determines the sterility of infecund hybrids. For a century the observers who have examined sterile hybrids have noticed an habitual deficiency of pollen in such plants; but they experienced more difficulty in distinguishing a vicious conformation in the pistil. One of them, Klotzsch, even thought himself justified in asserting that sterility is never due to the imperfection of the latter organ. The author of the present memoir has made this portion of the subject a matter of attentive study—direct so far as the pollen is concerned, and indirect

as relates to the pistil. With reference to the pollen he has confirmed what was already known, and with regard to the pistil he has concluded, from divers observations, that the exterior parts of that organ are ordinarily well formed, and that we must sometimes seek in the imperfection of the ovule the cause of sterility. We regret that time failed for sustaining this opinion by the help of the microscope.

"Not content with replying by experiment to the numerous questions put by the Academy, he has endeavoured to throw light upon divers points, some obscure and others not yet studied in the history of hybrids. He has confirmed what was known to Sageret, namely, that in a hybrid the character of its two factors were often seen, not confounded, but brought near; as for example, that the fruit of a hybrid Datura, born of two species, one having a smooth and the other a spiny capsule, presents smooth surfaces in the midst of a surface generally spinous. This *disjunction*, as he terms it, he explains by the presence in the hybrid of two specific essences, which tend to mutual separation more or less rapidly. He sees even in this disjunction the veritable cause of the return of fertile hybrids to the specific types from whence they proceeded. He has, moreover, established a fact not previously suspected, that the pistil of a plant can at one time undergo a legitimate fecundation and a crossed fecundation, that is to say, two fecundations, simultaneous and distinct, so that the fruit produced may contain both normal and hybrid seeds. He has also recognized that a pollen—a stranger to a plant—being unable to cause the growth of an embryo in its ovules, may, nevertheless, produce an excitement which determines the production of a fruit normal in appearance, but without seeds, or with only infertile seeds."

ADMIRAL FITZROY ON THE WEATHER.*

Few men have done so much practical good with so little pretence as Rear-Admiral Fitzroy, whose forecasts of the weather are looked for with eagerness all round our shores. The science of Meteorology being in a very imperfect state, and atmospheric conditions depending upon a great variety of circumstances exerting a highly complicated action, absolute *prediction* is not possible, and is distinctly repudiated by the scientific sailor, to whom his own profession and the public owe so much in the way of serviceable warning and useful instruc-

* *The Weather Book*. A Manual of Practical Meteorology, by Rear-Admiral Fitzroy. Longman and Co.

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tion. In France the Admiral's labours are highly appreciated, and we apprehend the government of that country will find itself obliged to follow the excellent example of our own in the establishment of a "Meteorologic Office," by which the probabilities of coming weather may be made known. A recent number of *Cosmos*, commenting upon our system of weather-signals, observes that "the warnings given by Admiral Fitzroy have saved many vessels from certain disaster, but human cupidity has often neglected his indications." This is no doubt true, but we cannot wonder that success should be slower than benevolent desire, as the world is partially governed by conservative instincts, and those who introduce beneficent novelties must move a huge load of rubbish, in the shape of ignorance, prejudice, and obstinacy, before the ground is clear on which they can operate with effect. The unintelligent man desires to repeat to-day what he did yesterday, without the labour of progress, or the trouble of research. The intelligent man takes a nobler view of nature and her possibilities, life and its duties. He feels that to-day should avoid the errors of yesterday, do something to make up its short-comings, and lay the foundation of completer action for the day that is to succeed. Among the unintelligent class, Admiral Fitzroy may have met with the treatment they habitually accord to benefactors who disturb the equanimity of indolence, or torment the laziness of repose; but the scientific contemporary we have quoted speaks truly when it says, "The science, of which this distinguished man, in spite of sarcasm, is the apostle, is in its infancy. No one is more ready than he to admit this. It may at times deceive us—of this there is no doubt, but we may hope the time will come when it will speak with perfect surety. Even now, when Admiral Fitzroy hoists his alarm signals at the ports, a storm is probable, and prudence commands small vessels or weak ones not to tempt the danger of the seas."

It may also be observed that all the existing means of intimating probable weather changes are not yet at the disposal of the Meteorologic Office, and those who have read our notices of the investigations of Father Secchi at Rome, will be prepared to believe that the variations of force and direction in the magnetism of the earth afford indications which are not to be despised.

Admiral Fitzroy has effectively contributed to what we may call the science of weather observation. He collects information from a number of places, chosen with reference to their meteorological position, and this information he interprets according to a theory, which is probably correct as far as it goes, and then publishes, through the newspapers and by signals, the *forecasts* at which he arrives. Occasionally a storm

may come not included in his programme, or his danger drum may be hoisted for a tempest that does not appear at the appointed time and place. It would no doubt be more satisfactory if greater certainty could be introduced, and that we may expect at a future date; but it is a grand thing to have got so far, as to exhibit all round our coasts distinct intimations of *tendencies* which are likely to take effect, and thus to establish a probability, according to which a vast number of actions may be regulated with the certainty that, *on the average*, the anticipated result will be obtained. The principle upon which the Admiral works can only be understood by a brief sketch of the causes of atmospheric perturbations, and to them we must devote a few explanatory lines.

The earth's atmosphere is divisible into two portions, lower and upper—the *stable* and the *instable*. It is not meant that absolutely no motion or change takes place in the upper division, but all the phenomenon of winds and storms occur in the lower one, as explained in a former number.* Opinions differ as to the total height to which the atmosphere extends. Admiral Fitzroy supposes that "as air, from ten to twenty miles seems a probable total depth," while about seven miles seems to be the limit in which man can exist. We do not perceive precisely what the Admiral means by the phrase "as air," but he may agree with the opinion of Quetelet, that the composition of the atmosphere may not be the same at great elevations, where the pressure becomes infinitesimal. However this may be, we do not coincide with his view that the total height is less than is usually supposed, but prefer the opposite supposition of the distinguished Belgian philosopher. Still, so far as relates to weather prognostications, our researches must be chiefly devoted to what takes place within a few thousand yards of the earth's surface; and if the loftier regions—in which miles of elastic matter in the gaseous form contribute next to nothing to the total weight of the atmosphere, as shown by the barometric tube—should ultimately be found to exert a noticeable influence upon the perturbations of the lower layers, it will probably be on account of the magnetic disturbances of which Quetelet conceives them to be the scene. The instable portion of the atmosphere is much lower in winter than in summer; but even when its volume, and consequent height, is enlarged by the action of solar heat, it cannot reach much above the highest mountain top. The chief cause of air currents or winds is undoubtedly the action of the sun; but the earth's rotation must not be disregarded, as it is very important, and the moon probably exerts a tidal influence upon the air as well as upon the water of our globe.

* Quetelet, on "Shooting Stars," No. 13 (vol. iii.), p. 34.

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If no disturbing operations took place, we should only have hot air rising from equatorial regions, and being replaced by colder streams from the less heated poles. The real facts are, however, in the highest degree complicated, as many distinct forces contribute more or less to excite motion at different heights and in different directions, and a host of circumstances, such as the distribution of land and water, mountain ranges, plains, etc., etc., produce modifications over a wider or smaller range.

Notwithstanding the mobility of air, the commingling of currents of different densities does not take place as quickly as might be supposed, and we are all well aware of the obstinacy with which ordinarily-constructed rooms resist a complete ventilation, and of the amazing change felt by placing ourselves just inside or just outside the lintel of an open drawing-room door, at one of those afflicting ceremonies called an evening party, where the guests largely outnumber the chairs, and demonstrate how little oxygen is necessary for the mere sustenance of human life. These facts must be borne in mind, or the co-existence of adjacent currents of different densities, each pursuing an independent course for hundreds of miles, will not be understood. Liquids mix with similar slowness, as may be seen if a glass of cold red wine is slowly poured into a tumbler of hot water, and no spoon permitted to accelerate the union of the two. Should the reader think this illustration more domestic than poetical, or object to it upon teetotal grounds, we may remind him of the story of Arethusa, so exquisitely told by Shelley. The startled nymph rushed to the sea to escape the violence of Alpheus, and as she took her flight through the waters,

> "Behind her descended,
> Her billows unblended
> With the brackish Dorian stream."

The ocean exhibits similar phenomena for thousands of miles. Admiral Fitzroy tells us that, "taking, with Dové, north-east and south-west (true) as the wind poles, all intermediate directions are found to be more or less assimilated to the characteristics of those extremes, ... and all *varieties* of winds may be clearly and distinctly traced to operations of the two constant principal currents, polar and tropical—*our* north-east and south-west winds." Polar currents are cold, dry, and positively electrical. Tropical currents warm, moist, and negative. Mixed currents have necessarily intermediate qualities, and continued collisions and conflicts occur between currents of all kinds. The state of affairs on our own coasts is well shown in the following passage from the Admiral's book:—"A stream of polar wind traverses the North Atlantic over Ireland and Scotland. As it

advances southward, it also moves (or is carried with the whole atmosphere) eastward, so that its effect is first felt in Ireland and Scotland. Advancing southward still, before approaching Norway, it is impeded by Scotch highlands (4000 feet), and then affected by Norwegian mountains (8000 feet). The increasing current of air (or *wind*), advancing, widening, and augmenting in momentum, passes round Scotland, between it and Ireland, along the Scottish eastern shores, and urged from behind, while in front checked and deflected by Danish, Dutch, and French coasts, this *polar* wind becomes more or less *easterly* on our coasts. There is no *true* east wind in our zone that has come from any *considerable distance due east*, moving towards the west. Polar winds deflected by local configuration and the earth's rotation become more or less easterly. When a tropical current is advancing, its extremes intermingle with the yielding or diminishing opposites (the polar), deflect them, and (affected also by local configuration of land) become south-easterly before they turn to southerly, and then to south-west." This is the usual order, but retrograde movements may take place, giving rise to squalls. A low barometer, with moisture in the air, as shown by Mason's hygrometer or other instrument, and a warm temperature, are the effects of the tropical current. On the other hand, a high barometer, diminished moisture, and falling temperature are the effects of the polar current. At times, however, the disturbing influences prevail over the normal, and during the last winter south-west winds have occasionally brought frost, while the temperature has risen during the period in which the air currents have been from the north.

These considerations will enable the reader to appreciate the system of weather *forecasts* introduced by Admiral Fitzroy, which is founded upon the indications of ordinary instruments, barometers, hygrometers, and thermometers, and upon the ordinary march of atmospheric currents, by which a particular state of weather in one place affords grounds for supposing what will be its state in other places situated so as to receive a similar, though perhaps modified, influence at a later date.

Upon the difficult question of the action of the moon, Admiral Fitzroy has an interesting chapter, and he does not consider that the probability of an important tidal influence is invalidated by the fact that the barometer does not give proportionate indications. He believes that there is "a continuous overflow of air, like that described by Dové and others, which not only prevents much sensible increase of statical pressure or tension, but augments the dynamical forces of the tropical currents of air, periodically by lunar periods, and diurnally also." This theory is probable, and the Admiral states that "recurring

periods of about fourteen days (semi-lunar), of seven, and of three or four days, have been traced, however masked or irregular, more or less synchronous with the moon's phases, *occasionally*, and then for a few times rather correspondent, therefore evidencing some kind of connection." The Admiral also observes that the consecutive actions of the moon in raising and causing an overflow of a mass of air must give rise to periodical impulses bearing a different direction to the normal currents.

"During the moon's passage from quadrature to syzygy her action on air currents should increase, and conversely, when she has great north declination, it ought to be greater here than when she is far south, and when in perigee greater than in apogee. Tabular records show such are the facts." Abstract reasoning tends to the conclusion that the moon must influence our atmosphere, although forces more powerful than that exerted by our satellite may counteract or conceal her work, but, as we shall see, distinguished authorities adopt conflicting views.

Admiral Fitzroy appears to connect the successive impulses to atmospheric movement given by the moon with the daily changes that occur at intervals of about six hours. Lunar actions may have something to do with these, but they seem more directly referable to the operation of solar heat and of radiation. Quetelet says, "If we compare the variations of the barometer with that of the thermometer, we observe that oscillations of pressure as well as of temperature are much stronger in winter than in summer;" but he adds that in autumn there is less difference in the barometer and thermometer than might have been anticipated. He likewise observes that the diurnal variations of the barometer, which take place at intervals of about six hours, exhibit peculiar displacements, so that in winter the interval between the maximum and minimum of pressure diminishes a little, and augments in summer.*

Professor Lamont believes that the sun exerts two influences upon the diurnal variation of the barometer, one that of heat, and the other of an "electrical" attractive force; and Professor Plantamour considers that the tidal action of the moon on the air is shown to be insensible, by observations which he carried on through twenty-four lunations. He says,† "I have taken the mean barometric heights, observed at different hours, the day of the syzygy, the day before, and the day after; the day of the quadrature, the day before, and the day after." He then gives the result of 144 days at the syzygy epoch, and of 144 days at the quadrature epoch, which do not correspond with what might be computed from the lunar-tidal theory. He also gives the hours at which the maxima and minima occurred

* *Physique du Globe*, p. 13. † *Archives des Sciences*, No. 61, p. 72.

at syzygies and at quadratures, and remarks, "the second terms (minima) are nearly identical in value, and the time only differs a few minutes; while if the atmospheric tide came from molecular attraction, exerted by the moon as well as by the sun, the time of minimum at the quadratures ought to have changed by six hours, and its value should have been reduced about one-third."

We do not presume to decide this very difficult question, and regret that the length to which our remarks have already extended precludes the notice of many important points in the *Weather Book*, a work which will interest and instruct many readers who would be alarmed at the sight of a more formal treatise, and which is illustrated by numerous valuable diagrams, to which the student will be glad to refer. The present edition is a handsome one, and necessarily expensive; but looking to the popular interest of the questions discussed, and the good that would result from placing the Fitzroy philosophy within the reach of seafaring men and agriculturists, we hope the respected firm of Longmans, to which the copyright belongs, will be able to accommodate itself to modern ideas and publish a cheap *Weather Book* without delay.

NIEPCE DE ST. VICTOR ON HELIOCHROMY.

In the Intellectual Observer, Vol. I., page 163, will be found some account of the reproduction of colours by the photographic process of M. Niepce de St. Victor, who has recently brought the subject again before the French Academy, in a paper from which extracts are given in the *Comptes Rendus*,* whence our present information is derived.

After observing that the reproduction of colours in the dark chamber affords the best exhibition of the powers of heliochromy, which, although not competent to obtain all results, has yet achieved an important success, the writer explains that he has now surmounted the difficulty of obtaining yellow tints. At first, he reproduced red, green, and blue with facilty; but if yellow appeared, it was accidental; but he now developes it with certainty, by acting upon the silver plates with hypochlorite of soda in preference to potash. He finds chloride of tin, aldehyde, and tincture of benzoin, especially that of Siam, contribute to fix the colours; and he observes that, if we hold a heliochromic picture at a certain degree of incidence, the colours appear more vivid and the shadows more intense. He

* January 12th, 1863.

adds, that when the model—a doll—is illuminated by solar rays, the colours obtained in the dark chamber are much modified and more brilliancy obtained.

The binary or secondary colours of the artist are decomposed by heliochromy; and M. Niepce de St. Victor remarks that if M. Edmund Becquerel has really obtained a complete solar spectrum by this method, such a result would indicate that the spectrum colours are simple, and not composed, as Sir David Brewster conceives, by the superposition of three monochromatic spectra—red, yellow, and blue. To illustrate the effect of light on a mixed colour, M. Niepce contrasts the result obtained with different kinds of green. The green of an emerald, of arsenite of copper, oxide of chromium, sulphate of nickel, or malachite, is reproduced by heliochromy; but green composed of blue and yellow pigments give a blue result. This suggests the notion that there is an essential difference between simple and compound greens, although they may appear the same to the eye. If a clear blue glass is placed over a clear yellow one, they transmit a green light; but the action upon a heliochromic plate is that of blue only, even when the blue glass is placed between two yellow ones. In like manner, a yellow glass and a red one, producing orange by transmitted light, only yield a red on the sensitive plate. Red and blue glasses at first afford a violet tint, because the sensitive plate is itself red, but after a little time the effect is blue. If an orange glass replaces the red one, the blue tint appears the more quickly. The green of grass is reproduced by a blueish grey; blue greens, like dahlia leaves, yield a more decided blue; and yellow or red leaves are reproduced with fidelity in proportion as the blue tints are absent, which M. Fremy has shown constitute, with yellow, the green of plants. The eye of the peacock's feather can be imitated well, so that the colours appear green or blue, according to the angle at which it is seen.

PRIZES OF THE FRENCH ACADEMY.

In the mathematical section of the *Academie des Sciences* no prize was adjudicated for papers on the question of Tides at the principal ports of France, and the subject was remitted for competition in 1865. Two thousand francs and a medal of half that value were adjudged to the author of papers on the "Theory of Plane Curves of the fourth order." The "extraordinary prize" of 6000 francs for an essay on the "Application of Steam to Naval Warfare" stands over. The chief astronomical prize (Lalande's Foundation) was given to Mr. Alvan Clark for his discovery of the companion of Sirius with an achromatic telescope of his own making, 18½ inches in diameter and 23 feet long, and thus exceeding by 3½ inches the aperture of the grand instruments at Pulkowa and Cambridge, U. S. The Montyon statistical prize was given to M. Mantellier for a memoir on the "Value of Provisions and Merchandize in Orleans, from the fourteenth to the eighteenth centuries inclusive." Among other curious matters it appears that in 1439 the city of Orleans bestowed a pension of two livres Tournois per month, estimated at 23 francs 91 cents present money, on the mother of Joan of Arc. The average price of corn at that period was, however, so much lower than at present, as to make the corn value of the pension equal to 827 francs a year. An honourable mention was given to M. Champion for a work in four vols. 4to on "Inundations in France, from the sixth century to the present time." From the statistics collected by the author, the Commission report that "the magnitude of inundations appears to have been the same in all historical periods—at the epoch when ancient forests covered the soil, and at times when the removal of the wood has been a subject of complaint." The Bordin prize was adjudged to M. Carl Miersch, of Dresden, for a paper on the "Causes which Influence the different Positions of the Optical and Chemical Foci in Photographic Lenses."

No prize was given for papers on the "Comparative Anatomy of the Nervous System of Fishes;" but an essay by M. M. Philippeaux and Vulpian possessed so much merit as to be rewarded by 1500 francs. The very curious question of Vegetable Hybrids having been carefully investigated by M. Naudin, a prize was adjudged to him, and honourable mention made of another paper by M. Godron. M. Naudin finds experimentally that the fecundity of hybrids is in general proportioned to the resemblance in external characters of the species which produce them, but not always. For example, plants belonging to Datura, Nicotiana, and Cucumis furnish instances of species closely allied in external appearance, which commingle with difficulty or yield only sterile hybrids, while other species of greater botanical diversity readily produce hybrids of great fertility. Other points of interest appear, to which we have reverted in another place. The important researches of M. Balbiani on the "Reproduction of Infusoria," which we have already laid before our readers, were very properly rewarded by a prize, and another was given to M. M. Chauveau and Marey for "Studies on Cardiac Circulation,"

noticed in our first vol., p. 84. M. M. Cruveilhier, Lebert, and Frerichs received prizes for Anatomical and Medical works. M. Pasteur received the Alhumbert prize for 1862, for his experiments on "Spontaneous Generation," which have been fully explained in our pages; and M. de Bary received honourable mention for "Researches on the Development of Parasitic Fungi;" and that for 1861, the subject being "On the Modifications which can be Produced in Development of a Vertebrate Animal by External Agencies," was divided between M. Dareste and M. Lereboullet for elaborate experiments on fowls' eggs.

The Medical and Surgical Commission reported that no work laid before them on the Treatment of Cholera, or the Causes of Fevers, merited a prize; but they proposed a pecuniary award to M. Barralier for a paper on the "Non-Identity of Typhus and Typhoid Fevers." In 1837 a paper supposed to establish their identity was greeted with a prize.

MINSTRELS OF THE SPRING.

BY SHIRLEY HIBBERD.

How would a blind man know, without human aid, of the changes of the seasons? In this country, and in such a season as the present, he would gain no hint from the prevalence of storms, the chills of winter, or the warmth of spring. On Christmas day we had May temperature and sunshine; and during February it has been so warm that roses have opened their blooms in the neighbourhood of London. But the blind man, whether a Homer or an Œdipus, a Huber or a Belisarius, if ever an observer of nature in the days of his proper vision, would be able to count off the months, and sometimes the weeks, by the voices of the birds. True to the almanacs, within a few days, from far to near, and in some cases true almost to an hour, the songsters of the woods and gardens publish their arrival, and their changes of mood, and feeling, and prosperity, in their calls, carols, and utterances of fear, warning, anger, love. There is always a dead pause from the middle of August till the middle of October, when the sparrows and chaffinches have it almost to themselves, to do as they please with the hedgerow and woodside echoes. Then the concert begins again, with the robin as leader, and a succession of performers follow, fieldfares, redwings, missel-thrushes, song-thrushes, blackbirds, wrens, and finches of many kinds. But all these make little more than a confused twittering, amidst which rises, distinct and clear, the rich but melancholy warble of the robin, and the loud detached whistlings of blackbirds and thrushes. Yet though our winter music

is poor compared with the season when spring and summer mingle among the darkening greenery, we are much better off than is commonly supposed. October brings us the migratory *Merulidæ*, the fieldfare (*Turdus pilaris*, WILL.), the redwing (*T. Iliacus*); and the missel-thrush (*T. viscivorus*), which never leaves us, appears as a migratory bird amongst the gardens, where it is seldom seen at other periods of the year. With these we may group the crossbill (*Loxia curvirostra*), with its musical "tutter tutter," the siskin (*Fringilla spinus*), with its incessant small song, so like, in some of its odd passages, the sound of the loom, that it is the greatest favourite as a pet among the weavers of Nottingham and elsewhere. The mealy redpole (*Linota canescens*) visits us only in hard winters, and has this season been a scarce bird, and when plentiful its song is but a poor affair; but it has a musical companion in the mountain linnet (*Linota montana*), which sings nearly as well as the common linnet. As for the finches they literally smother the gardens occasionally, then break up and appear singly, and make a plentiful twittering when food is abundant. There is the common wren (*Anorthura troglodytes*, NIAC.), the gold-crested wren (*Regulus auricapillus*, SELBY), and the fire-crested wren (*R. ignicapillus*, MUDIE), always with us, flitting from bush to bush, rarely mounting among the branches of high trees, and all of them so easily approachable that it would be possible to train quick-sighted, nimble boys to take them by the hand. The pied wagtail (*Motacilla alba*), and the greenfinch (*Fringilla chloris*, TEMM.) give their occasional touches of music, the first about the margin of the pond, and the second among the orchard trees, where it performs its harsh "chink" with a pertinacity worthy of a softer throat.

These are not all the true winter songsters, but of the rest we can scarcely take note, for they are either rare and local in occurrence, or contribute so little to the concert as to be scarcely worthy of notice. But the opening of the first crocus is the signal for a general outburst. Then the loud blackbird, with his restricted compass and unskilful execution, makes amends for poverty of art by lustiness of expression, and leads the way, as the robin did before, but to a nobler chorus. From every copse and hedgerow now resounds the full melody of the garden thrush, a perfect song, monotonous, yet so full and joyous that we rarely pause to criticise; and above it rises the ousel's clarion, shrill and decisive, pronouncing that the time of singing birds is come; and the copses are being newly drest with spanglings of gold and silver. All the winter long I have heard the skylark trilling out his cheerfullest of melodies in the sunny sky over our suburban meadows; and now the sky is on bright days almost dotted with these spiral-flighted

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songsters, the freest and wildest of all the birds of spring. I like to note at this season how far our poets and painters have hit or missed the mark in their renderings of nature. That oft-quoted song from Shakspeare's "Midsummer Night's Dream"—

> "The oosel-cock, so black of hue,
> With orange tawny bill;
> The throstle with his note so true,
> The wren with little quill,—*Act* 3, *s.* 1,

is next akin to a zoological monograph. "So *black* of hue" is no haphazard expression; the "oosel" is the blackest of all birds, blacker some degrees than the raven; and the "orange-tawny bill" is such a perfect complement of colours that it is unquestionably the most artistically painted of all the British aves. Contrast Shakspeare with Pliny, who tells of blackbirds becoming red in winter, and see how the quaint writer and careless observer confounded the sexes, and made the brown female a transformed and dilapidated gallant. Pliny does not tell of the most curious of all the facts in the history of the blackbird, that it is the most subject to albinism of all the birds of Europe, and a genuine *white* ousel is by no means a rare sight. I remember seeing one when a lad; it was shown for sixpence, along with a three-legged colt, in a stable-yard in the Black-friars Road. There is a cream-coloured specimen in the British Museum, and some years ago there was one in the Zoological Gardens with a black body and a white head. The sparrow is also much subject to albinism, but in a less degree than the blackbird; I saw two white sparrows in the collection of Dr. Hobson, of Leeds, some few years ago.

But is the "oosel-cock" of Shakspeare the same as our quarrelsome and loud-spoken blackbird? some have denied the identity, for no good reason that was ever alleged. Drayton studied nature in the same fields as the great poet, and at the same time, and he classes together two birds that have inevitable companionship—

> "The *throstel*, with shrill sharps, as purposely he song
> T'wake the lustless sun, or chiding that so long
> He was in coming forth, that should the thickets thrill:
> The woosel, near at hand, that hath a golden bill."
>
> *Poly-Olbion*, 13.

Not to pass from Shakspeare too hurriedly, for *he* is the chief of our spring minstrels, who stood between the winter song of Chaucer and the summer-time of literature, when Milton made our language marvellously vocal; observe the next line—

> "The throstle, with his note *so true*."

When the Hon. Daines Barrington classified the chief singing

birds as to their comparative excellences, he assigned to the thrush four points of perfection (twenty being the maximum) in all the qualities of mellowness, sprightliness, plaintiveness, compass and execution; and there is but one other bird in that table classed with equal numbers all through, and that is the titlark, a charming songster, which has twelve points in each section. The song of the throstle is essentially true. When you hear now a huge whistle, followed by a discordant jar—that is the ousel; when next you hear a mellow, lively, plaintive song, lusty and loud—that is the throstle, the nightingale of spring. It did not escape the quick perception of Shakspeare that loud and lively music in a regular measure prompts the hearer to dance or sing to the same tune, and in the "Merchant of Venice" Portia describes the susceptible sensitiveness of Monsieur Le Bon: "If a throstle sing, he falls straight a capering"—a passage which might any day form a text for an essay on analogies and sympathies. What now shall we say of the last line of the song, "the wren with little quill?" Let us suppose—a fair supposition in regard to a lad who put a longing eye upon the deer in Lucy's Park—that Shakspeare was in his youth given to the practice of the gentle craft beside the leafy Avon; then he would have prized, as modern anglers do, the tail feathers of the wren as the best of all baits for trout, and the remembrance of the fact would suggest the "little quill" as he grouped together the three liveliest and truest birds of winter and early spring. If any angling reader of this has found excuse for using the gun to obtain wren's tails, we counsel him to adopt the more merciful plan recommended by Mr. Broderip: Set a lad to catch wrens by hand—an easy thing to do—and, having plucked a few of the tail feathers, let the bird go free; he will soon repair the loss, and be none the worse for the robbery.

Modern poets freely use the license allowed them, and many are the violations of truth observable in works which rank among our classics. I have several times during the past winter watched the groups of fieldfares which haunt the quieter parts of our meadows and arable lands, and have compared Scott with Gisborne, to note which had painted nature in the truest colours. The fieldfare arrives early in October, and leaves us some time in April, and never stays beyond the second week in May. Yet Scott in the "Lady of the Lake" describes it as a summer bird—

> "Beneath the broad and ample bone,
> That buckled heart to fear unknown,
> A feeble and a timorous guest,
> The fieldfare framed her lowly nest."

Gisborne indulges in the extreme of accuracy, reminding

one of the "inventory style" of Crabbe, yet his picture is charmingly truthful—

> "Lo! on yon branch, whose naked spray o'ertops
> The oak's still clustering shade, the fieldfares sit,
> Torpid and motionless, yet peering round,
> Suspicious of deceit." *Walks in a Forest: Winter.*

Among our Stoke Newington birds the principal at this season are the commoner species of *Merulidæ*, the common wren, the skylark, woodlark, robin, and hedge-sparrow. As for the wrens, they flit about in the hedgerows like mice, and utter their cheerful miniature song with as much boldness as the bravest of our songsters. Now among the special indications of spring must be noted the occasional appearance of *hen* robins, and everywhere among the songsters pairing time is anticipated through the unusual mildness of the season. Thus we have a commixture of warblings, and at midday, when the blackbirds and thrushes sing with less vigour than at dawn and dusk, the robins and the hedge-sparrows have the welkin almost to themselves. Already the robins have paired, and commenced their household work, perhaps to be undone by eastern blasts when the fruit-trees are all in blossom. But whoever would now combine literary with ornithological musings may make a scientific study of the "Babes in the Wood."

There have been but few experiences gained as yet in the use of synthesis in natural history. It is all analysis at present, but in the future of the physical sciences we must hope to see synthetical methods of reasoning turned to as good account in this science as in chemistry, astronomy, and geology. When I look around me at a number of pet birds in cages, I cannot resist the temptation to work out general conclusions as to the history of species from the material furnished for the purpose by individuals in a state of confinement. Our common observations about the changes that occur in the habits of animals when brought directly under the influence of man are, after all, very vague and unsatisfactory. I find, as do other folks who keep pet birds, that in a state of confinement the season of song is, in the majority of cases, greatly prolonged; and if it be asked, "Why is this?" the reply is obvious: that shelter, warmth, and abundance of food favour a joyful state, and this the bird expresses in its own way, and so repays us for our attention. We are just emerging out of winter into spring, and the winter has been unusually mild, and many birds whose voices are hushed during the season of frost and snow have been continuously vocal; and the plentifulness of bird music confirms me in the opinion that the comforts of life have very much to do with frequent expressions of joyousness. So,

passing from generals to particulars, if we note the kind of food which any particular bird prefers and thrives upon, we have somewhat of a key to its habits and history when in a state of nature. The birds we feed on soft food soonest suffer during hard frost, and so severe winters kill off blackbirds, and thrushes, and larks, and perhaps robins; for then their sustenance ceases to be available, even if plentiful, and is more likely to be scarce in quantity, and therefore doubly unavailable. The sentiment which prefers the free, wild song of the uncaged bird is wholesome and to be encouraged, but it is a question if the history of any bird can be truthfully written without the aid of such opportunities for observation as are afforded by the cage and the aviary. Audubon tells of parrots scratching each other's heads when congregating on the branches of their native trees. I believe the statement, because, when I allow a couple of parrots to exchange familiarities, the first thing they invariably do is to engage in mutual scratching, and with extraordinary earnestness. I had some doubts about the size, and shape, and colour of the eggs of the small white cockatoo (*Psittacus sulphureus*), until a bird of mine (strangely called in our household language "the boy") presented me with a couple of eggs—pure white, and the size and shape of plover's eggs. When I reflect upon the mysteries of migration, I am strongly tempted to sweep away all the fanciful theories of "mysterious instinct," and reduce the phenomenon to a question of food and temperature; and the conclusions in this direction which caged birds have suggested I find pretty well exemplified in observations of natural events, and remarkably so in the experiences of this winter. Let us endeavour to illustrate the case by a few remarks on the minstrels of the winter.

The *Sylviadæ*, or "warblers," which visit us in spring and depart in autumn, have their counterparts in the *Merulidæ*, or thrush tribe, which visit us in autumn and depart in spring. True, many of the noblest of the *Merulidæ* are permanent residents, and a few are only partially migratory. One of the most regular of the winter visitants is the fieldfare thrush (*Turdus pilaris*, Will.). It comes in October, and appears in various districts at different dates, as the individuals spread themselves over the country. At Stoke Newington it is a *rara avis*, yet I generally see a few in the early part of November, and thence to the end of March. Very often on mild damp days flocks of fieldfares and redwings (*T. Iliacus*, Will.) traverse the flat meadows together, generally in the wake of feeding crows. In a season like the present these birds are fat and occasionally vocal, their food consisting wholly of insects and molluscs, which they find in greater plenty in the track of the crows than elsewhere, those expert foragers serving as jackalls to indicate

the locality of prey. But in a hard winter the fieldfares and redwings soon get thin; snails and slugs and insects are scarce, and they betake themselves to the berries of holly, berberry, ivy, mountain-ash, and hawthorn; and however plentiful these are the birds barely secure a subsistence from them, and, while trusting to such food, are invariably silent. When the Romans fed these birds for the table their food consisted of figs and flour; they might have fed with berries to any extent and with any variety, and the result would have been complete failure. Now, let any possessor of caged *Merulidæ* test the dietary of these birds by giving them abundance to choose from, and what berry will they touch while good "paste" is obtainable, and is there one that will prefer a haw or sloe to a fat slug or wriggling worm? Not one. But give them snails in plenty, and you shall be rewarded with a concert.

Our winter concerts would, however, be very poor were we dependent only on wandering minstrels. The resident songsters keep the echoes of the hedgerows awake, and what a variety of these we have that brave our winters, and give us Christmas carols and new-year songs. Since the beginning of December scarce a day has passed that I have not heard the notes of the blackbird (*T. merula*); but in a hard winter he, too, would be mute till the eastern sky showed again some of those saffron bars that indicate the dawn of spring. So the song thrush (*T. hortensis*) has been singing joyously all the winter long, though not in the best tone, and the missel-thrush (*T. viscivorus*) has nearly equalled it very often, and has been unusually plentiful here of late. Now the balance of song is very nicely established between summer and winter. The summer song of the nightingale has a counterpart in the winter and spring song of the garden thrush, a more powerful songster, though so deficient in compass, mellowness, and execution; and in place of the whole tribe of warblers, with the blackcap at their head, we have in winter a number of lively finches and larks, with the robin for captain; and so the months are attended by the several minstrels of the seasons. With every advance of the season the song thrush increases in volume of voice, and in volubility of expression. There is such a joyous outpouring of song that the few notes over which the song ranges, and its poverty as a composition, are unnoticed while we yield to the spirit of gladness which pervades every utterance, and accept quantity for quality, and esteem ourselves happy that the season of awakening has so suitable a voice. But as the garden thrush rises to the full swell of his jubilant melody, the missel-thrush declines in power, and actually improves in sweetness, though it is certainly one of the least musical though the largest and handsomest of the thrushes. To hear the discordant scream this bird will utter

when the wintry storm has just begun to lash the pane, and cause the trees to creak and moan, is to acquire somewhat of a horror of the species. The way in which the songs of birds affect us could best be told by a master of thorough bass, and one of the essentials to the pleasurable study of ornithology is a knowledge of the laws of musical harmonies. The thrush is in reality a poor performer, but he sings in the chromatic scale, and every note tells with full power on the feelings. The song of the robin is remarkable for its compass and sweetness. Barrington assigns to it six points of mellowness, sixteen of sprightliness, twelve of plaintiveness, twelve compass, and twelve execution. Yet with all these excellences it does not affect us so strongly as the poorer performance of the thrush, and the reason is not hard to discover, for the robin sings in the minor key. But we must guard against being led into error in endeavours to analyse bird music according to the laws of harmony. There is no regularity of pitch, no correct concord of measure and rhythm, and often the odd disregard of the bird for principles which the musician considers of the first importance, affords us a pleasure to which there is no parallel among the attainments of the human performer. Here it is that Pope's line has a special application, the song bird knows how to—

"Snatch a grace beyond the reach of art."

NEW DECIMAL COINAGE FOR HONG-KONG.

BY JOSEPH NEWTON, OF H. M. MINT.

It is satisfactory to be able to announce that it is the intention of the British Government to cause a new and distinctive coinage to be struck for the young, but flourishing and populous, colony of Hong-Kong. The metallic currency of that place has hitherto consisted of as strange and heterogeneous a collection of coins as could possibly be imagined, and the confusion and mystification arising from this state of things are intolerable in the highest degree. Spanish and Mexican dollars are intermingled with small and large pieces of money from almost every part of the world, whilst the miserable specimens of Chinese mintage, known as "cash," which largely circulate among the native population, serve to make the jumble complete. It is in consequence of strong representations from the colonial authorities, and merchants of Hong-Kong, as to the evils and annoyances arising from this serious defect in the currency, that the home government has determined to remodel it.

XUM

Much care and caution will have to be exercised, no doubt, in the introduction of a new coinage, because a very large proportion of the inhabitants consists of Chinese, and their peculiar habits and prejudices must, to a certain extent, be respected. It will not be possible to wean the "Celestials" all at once from their ancient notions of monetary matters, or to familiarize them easily with our own views of the very terrestrial subject of pounds, shillings, and pence. The transition must, indeed, be made gradually, and, if possible, without shock to the feelings of John Chinaman. We believe that the Duke of Newcastle, in his official capacity of Secretary of State for the Colonies, has fully considered the difficulties which will have to be surmounted in effecting the proposed change, and the plan of operations agreed upon between him and the talented governor of Hong-Kong, Sir Hercules Robinson, seems to be well calculated for overcoming all the practical and moral obstacles in its way.

It is intended that the dollar shall, for the present at all events, remain as the unit of value, and that the new series of coins shall comprise decimal divisions of that unit. The

NEW COINS FOR HONG-KONG.

subsidiary coins will be named respectively, ten cent pieces, which will be of silver; one cent pieces, of bronze; and, for the purpose of humouring the Chinese, British "cash" pieces or mils, also of bronze. The first-named coin will be equal in value to the ten cent of Canada, or the tenth part of the dollar; the second, to the American cent; and the third, or British cash, will represent the one-thousandth part of a dollar. It may appear somewhat singular that coins of so small a value as this last—less considerably than the fourth of a farthing—should be deemed necessary; but the innumerable variety of articles

which, in the markets, shops, and street-stalls of Hong-Kong are fixed at the price of a single cash is at once a justification of the proceeding, and a proof of its necessity. The last census of the colony demonstrated the fact that there were 120,000 Chinese residents in it; and as these have from their childhood been accustomed to the use of the "cash," it has been thought advisable to supersede the rough native coin of that name by a well-finished and handsome specimen of English mintage, presenting some of the characteristics of the Celestial piece. It is, perhaps, scarcely essential to inform our readers that the "cash" of the Chinese empire is simply a thin disc of gun-metal, ornamented by hieroglyphics—if the term be admissible—and which has been cast in a mould, not struck from dies. It has, moreover, a square hole in its centre. The diameter and weight of the cash have varied considerably under different emperors, as have the Chinese characters supposed to ornament it. These inequalities have not tended to lessen the annoyances arising from the mixture of coins circulating in Hong-Kong. In the proposed new coinage of "cash," or mils, there will be, of course, uniformity of weight, size, and inscription. The hole through the centre of the piece will be retained. This may be regarded as a Celestial institution in fact, for all good Chinamen prefer stringing their money, like beads, round their necks, to carrying it, as we outer barbarians do, in our pockets. The hole will, as shown in our illustration, be a round one, of about three-sixteenths of an inch in diameter; and whether this arrangement will square with the ideas of our pig-tailed fellow-subjects, remains to be discovered. It certainly prevents the coins bearing the image of our beloved queen—a matter for regret—although its being a round, instead of a square hole, facilitates, mechanically speaking, the process of coining them.

The devices which ornament the "mil," it will be seen, are simple, and as appropriate as the perforation through its centre would allow. The Chinese characters forming the reverse of the coin are to the same purport as the superscription on the obverse. The first instalment of British "cash" transmitted to the colony will equal, it is believed, not less than twenty millions of pieces. The contract for striking these has been taken by the Messrs. Heaton, of Birmingham, but, of course, the work will be carried on under the direct supervision of officers of the Royal Mint. The smallest of the series of coins has been spoken of first, because really it is that which will probably become the most popular in the colony, and by far the largest number of pieces sent there will be of this denomination. There may be a little room for doubt as to whether the relative smallness of the British, as compared with the Native, cash, may not create some dissatisfaction in the Celestial mind;

but, as a rule, the Chinese are acute, and once they find that their new necklaces, although much lighter in weight, represent as much, or more, value than their old ones, they will be soon reconciled to the change.

There were persons nearer home who objected in the first instance to the introduction of the now popular bronze coinage, because of the comparative smallness of the coins composing it. They, however, have outlived their objections; and so will the native inhabitants of Hong-Kong, if they happen to have any, to the more portable cash or mil.

Of the ten cent piece an illustration is shown on another page, and it will be acknowledged that the designs of both obverse and reverse are excellent, as they are in the originals well engraven. There is a boldness and elaboration of workmanship about the profile of Her Majesty which cannot but command approval. The piece is well-proportioned too, an important point in all coins. One hundred thousand ten cent pieces will be coined in the first instance at the Mint, but these will be followed, in all likelihood, by several hundred thousands more.

A million of one cent pieces are to be struck immediately, and as our artist has done justice to the devices which are to ornament them it is not requisite to say more on that subject. The same remarks, indeed, which have been used in regard to the ten cent silver coin will apply with even greater force to the one cent bronze piece. It is only just to state that to Mr. T. J. Minton, Acting Engraver to the Royal Mint, is due the merit of engraving the reverse dies for the whole of the series of Hong-Kong coins, and of the obverse die of the ten cent piece. The obverse die of the one cent is identical with that engraved by the late Mr. William Wyon for the first, or, so-called "Godless" Florin.

It is presumed that the introduction of the three varieties of coin named will be attended with some degree of trouble; but a royal proclamation legalizing them throughout the colony, and published both in the Chinese and English languages, will pave the way for their appearance, and the rest may be left to the accomplished and active Governor of Hong-Kong.

That the Chinese are not unwilling to adopt new systems and improvements which recommend themselves to their good sense has been clearly demonstrated in the colony by their patronage of the chartered banks established there. The notes issued by those banks are cashed freely in the province of Kwang-tung, seventy or eighty miles above Canton, by native bankers, and at a charge of not less than one-tenth per cent. This, at least, is a hopeful sign, and it leads to the supposition that, in due time, other reforms may be effected among the

Chinese, provided they be instituted and carried out in good faith, and with a proper deference to their time-honoured, though rather exceptional manners and customs.

It is well known that the Chinese are excellent calculators, and the universal employment of the abacus, or *swan-pan*, in the schools of the Celestial empire is, no doubt, the great cause of this. With that instrument, Sir John Bowring has told us, the Chinese youth has been as familiar as with his hemetrical classic, the first and most popular of his school-books. From it he has drawn the most correct impressions of the relations of numbers one to the other, and he has acquired the habit of moving the balls on the wires of his swan-pan with wondrous rapidity. For the performance of decimal calculations this instrument, which we need not further describe, is especially valuable, and it is an excellent forerunner therefore of a decimal coinage.

On the whole, there is every reason to hope that the British Government and the authorities of the Mint will gain golden opinions from both native and foreign residents at Hong-Kong, once the new coinage shall find its way into the channels and creeks of general circulation there.

URANUS.—SILVERED GLASS SPECULA.—OCCULTATIONS.

BY THE REV. T. W. WEBB, F.R.A.S.

URANUS.

If our readers have succeeded in finding Uranus, during a season when it has been almost an achievement to find anything, and still more, if they have effected the "raising of a disc"—that is to say, if its apparent magnitude has increased in the ratio of the magnifying power, which is never the case with the "spurious discs" of fixed stars—they have no reason to be dissatisfied. They have at any rate done what the celebrated Sir Joseph Banks, the President of the Royal Society for many years, failed to accomplish. The announcement of Herschel's discovery in 1781, though he considered it at the time to be probably a comet (its planetary nature being first suspected by Maskelyne), was received with some distrust; and I have been told by a friend (since deceased) of the discoverer, that the learned President, and several Fellows of the Royal Society, having been unsuccessful in searching for it, Sir William, then Dr. Herschel, had a portable tube constructed of silk, packed up his specula, left Slough, and gave the incredulous party

the meeting upon the roof of Somerset House, where, the planet having been duly exhibited, Sir Joseph Banks took off his hat and bowed to the illustrious astronomer, the others present following his example.

To advance beyond the mere exhibition of a disc would require a degree of optical aid which few amateurs have at command; it may therefore, perhaps, be interesting to state some particulars as to this remote body, the result of investigations with the most powerful instruments. There seems great probability that it may be really a flattened spheroid, as this form appears to be the ordinary concomitant, if not the result, of rotation upon an axis, and an unrotating planet would be an anomaly, the existence of which ought not to be admitted excepting upon the strongest evidence. This idea is also well borne out by the analogy of Jupiter and Saturn; for Uranus is evidently a member of the same group with those great planets. It is a fact worthy of notice, that the curious interval in which such a multitude of asteroids, or more properly "planetoids," have been discovered during the present century, divides the solar system into two very unequal portions—an inner and an outer region, each district being distinguished by characteristics of its own. All the planets beyond the dividing space, notwithstanding striking individual peculiarities, have certain common points of agreement, in which they differ from those of the interior group; such as great magnitude, inconsiderable density, and a numerous retinue of satellites.* When, therefore, we find so extensive a compression at the poles of Jupiter and Saturn, we should naturally expect a similar feature in the case of their next neighbour. Yet it is a question whether the amount of flattening, so conspicuous, even with small instruments, in those two great planets, is sufficient, in the case of Uranus, to be recognized even with the most powerful telescopes. Herschel, in 1782, considered the disc to be decidedly circular; in 1783,† 1792, 1794, and 1795, with various reflectors and magnifiers, he thought it slightly elliptical. Schröter, while contrasting it in 1802 with the newly discovered planet Ceres, speaks of its appearance, with his excellent $9\frac{1}{2}$-inch speculum, as that of a miniature Jupiter, except in the absence of ellipticity. Mädler, during some very fine weather in September, 1842, using a power of 1000 with the celebrated Dorpat achromatic, and measuring repeatedly 24 diameters at intervals of 15°, found a polar flattening $= \frac{1}{10 \cdot 85}$, with an inclination of

* Though only one satellite has been certainly discovered to attend upon Neptune, this will not be considered an exception, if we bear in mind the amazing distance of the object, and the great disproportion in magnitude which exists among the satellites of Saturn.

† This date has escaped the notice of Arago.

axis = 160° 40′: having repeated a similar process in 1843, he gave the mean result = $\frac{1}{9.92}$. This would seem beyond exception; yet it is, though disappointing, instructive to find that it has not been confirmed by the yet superior instruments of Struve and Lassell. In 1787 and 1789, Sir W. Herschel strongly suspected the existence of two rings, not concentric like those of Saturn, but perpendicular to one another: in 1792, however, he abandoned the idea. This as well as the preceding instance, shows the degree of caution to be exercised in admitting as certain the indications even of the finest instruments, when the object approaches the limit of visibility. Excepting Lassell on one occasion, no one has ever surmised the presence of a spot upon this minute disc, and even he, with a 2-feet speculum, and in the sky of Malta, failed in verifying its existence.

Considering the small proportion of light which Uranus receives from a sun only 1′ 40″ in apparent diameter, and amounting to only $\frac{1}{370}$ of what we enjoy, its disc is more luminous than might have been expected; and hence Gruithuisen was led to suppose that it may, in common with Jupiter and Saturn, possess some native light. A more natural solution for the fact, which is certainly a curious one, especially in connection with the distribution, already mentioned, of the planets into two dissimilar groups, might be found in the supposition of a highly reflective material.

Those marvellous, but as it seems well-attested, peculiarities of the satellites of Uranus, the high inclination of their orbits to the ecliptic (amounting to 78° 58′), and their retrograde motion, so contrary to every known arrangement in the planetary system, would render them most interesting objects, if there were a chance of catching sight of them; but for ordinary amateurs the case is perfectly desperate. I do not know the smallest aperture which could grasp them. Smyth considered 5·9 inches utterly powerless. Lamont saw two plainly, and a third on one occasion, with the great achromatic in the Royal Observatory at Munich, having an 11-inch object-glass. From their extreme faintness much uncertainty has existed both as to their number and their distances from the primary. Sir W. Herschel thought he had discovered six; Arago, by including all the observations, however doubtful, of all the observers—the two Herschels, Lamont, Otto Struve, and Lassell—has made up eight; but evidently not much to his own satisfaction, nor, it may be presumed, that of any one else. In 1852 Lassell subjected Uranus to a long and most careful scrutiny, using a magnificent speculum of 24 inches in diameter, brought to such perfection by his own polishing machine, as to carry, in the air of Malta, a power of 1018 upon this feeble disc with "a remarkably hard

and sharp edge:" under these most propitious circumstances he was soon led to say, "I think it is high time that Uranus's establishment should be reduced. He has been luxuriating these many years with a retinue that I really believe does not belong to him, and therefore he must be cut down to four attendants, until some astronomer arises rich enough to present him with some more;" and his final conclusion was thus expressed:—"*I am fully persuaded that either he has no other satellites than these four* (viz., the two first seen by Sir W. Herschel, and two others added by himself), *or if he has, they remain yet to be discovered.*" From this decision there can be no appeal, excepting to the observer himself, who has now the fullest opportunity of revising it. He went out again more than twelve months ago to the same admirable station, with its hundred miles or more of sea in every direction, its equable temperature, and its peculiarly tranquil and transparent sky. He is armed with two still more superb specula of twice the diameter, and consequently four times the light-collecting capacity of his former one, and through the simple expedient of protecting them by a coat of varnish, their exquisite surfaces were preserved untarnished during the voyage. His observatory has been re-erected, and he has, it is known, long ago renewed his examination of Uranus. In the wish that in this, and all other respects, the result of his spirited expedition may answer his most earnest expectations, every reader of these pages will cordially join.

SILVERED GLASS SPECULA.

The old refracting telescope, of which there now remain so few specimens of any considerable size, that our readers may probably never have had an opportunity of seeing one, was by no means a contemptible instrument. The work that it accomplished in the hands of Huygens, Bianchini, Cassini, Maraldi, and other observers of the two last centuries, is a sufficient proof of its capabilities. While doing full justice to the admirable perfection of modern workmanship, we must feel that nothing can throw discredit on those who so fashioned the simple object-glass of former days that it could detect five of the satellites of Saturn, and show, even with an aperture of barely $2\frac{1}{2}$ inches, and a power of 90, the principal division of that planet's ring.* But however beautiful might be the figure and the polish of the lenses of Campani or Christian Huygens, the cumbrousness and unwieldiness of the machines which carried them were a

* I have seen, indeed, the latter object distinctly with a power of 80 on $3\frac{7}{16}$ inches, but only in such a way as to show that I possessed no great advantage over the original discoverers of that minute black line, which, according to De La Rue's measures, subtends an angle of only 0″·94, but to which W. Struve, Secchi, and Bond assign not so much as half that breadth—about 0″·4.

most serious drawback, and what we now call a "night's work" at an observatory would then have implied "work" indeed. The labour involved in such an undertaking may be estimated by any one who will look at the curious delineations appended to Bianchini's *Hesperi et Phosphori Nova Phænomena;* and though the ingenuity of Christian Huygens did something for observers in dispensing with the tube and all the marvellous appliances for bracing and stiffening it, the mere operation of getting the object-glass to a sufficient altitude was no trifle. So Derham found it when he had the loan of the 123 feet refractor, then, and still, belonging to the Royal Society: with characteristic simplicity he lays before the public his "chief inconvenience, the want of a long pole, of 100 or more feet, to raise my long glass to such an height as to see the heavenly bodies above the thick vapours. . . . . But, as I have been at considerable expenses already about these matters, and this I am informed would amount to £80 or £90, I thought it much too great a burden for the yearly income of my living."

The fate of such an apparatus was therefore not surprising when the invention of the reflecting telescope by Gregory and Newton, and of the achromatic by Hall and Dollond, reduced the length to one-tenth or one-twelfth part, without any sacrifice of distinctness. It sunk, never to be revived again; and ever since, the two constructions which superseded it have been competing for the preference. The reflector was the older, and in the hands of Short, about the middle of the last century, attained extraordinary perfection; but the achromatic, as the more convenient and less liable to injury, rapidly gained ground upon it, and would have quite outstripped it, but for the peculiar difficulty of procuring good glass. This was so great that even as late as 1829, Dollond had not been able to obtain a $4\frac{1}{2}$ inch disc of flint glass fit for such a purpose during the previous five years, nor one of 5 inches during twice the time; and hence the reflector maintained its superiority for the purposes of astronomical discovery. In the hands of Sir W. Herschel in England, and Schrader in Germany, the metallic speculum assumed gigantic proportions, and the rejection of the small mirror in the "front view" of the former was attended by an increase of light that for many purposes more than counterbalanced a slight want of accuracy in definition. But the achromatic was yet to have its turn. Fluids, as substitutes for the obnoxious flint glass, had not fully answered the purpose. Blair's beautiful adaptation of them had remained unnoticed, and seems to have been ill-suited to large apertures. Barlow's "correcting lens" of sulphuret of carbon had not been entirely satisfactory—it might possibly have been rendered so, but it came too late.

XUM

The difficulty had been conquered, though not by English opticians. Guinand had not toiled, and Frauenhofer had not shortened his days, in vain. Discs of fluid glass were manufactured of such magnitude and perfection, that the reflector, which with an equal aperture always returns less light than the achromatic transmits to the eye, lost its superiority, not only as a popular, but even as a scientific instrument. In a very few instances, such as those of the Earl of Rosse and Lassell, where labour and expense were disregarded, its enormous dimensions have kept it still ahead; but in the generality of observatories, public as well as private, achromatics have been adopted, of as large an aperture as circumstances would allow, reaching at Greenwich about $12\frac{3}{4}$ inches, and at the observatory of Poulkowa (the Czar's), Harvard (N. America), and Paris, nearly 15 inches.* This slight sketch of the present state of optical progress may serve to introduce a notice of a remarkable modification of the reflector, which has recently attracted the attention of astronomers, and will probably before long become more generally known.

Although it has been found that no metal is more suitable for such a purpose than the alloy of four atoms of copper to one of tin, commonly called *speculum metal*, which was hit upon at once by the extraordinary sagacity of Newton, and has never from that day been altered for the better, yet it has many and great disadvantages in the difficulty of casting it without pores, of cooling it without fracture, of working it without accident,† and of preserving its polish without injury; so that the field is open for much improvement. The obvious expedient of coating the back of a concave glass mirror with the alloy of mercury used for looking-glasses, would fail from the double image produced by reflection from two surfaces; and if the front of the glass were worked to a different curve, so as to get rid of this fault, the glass would become virtually a lens, and the error of colour—the great imperfection of the refractor—would be introduced; and though this might be removed, there would still remain an inevitable loss of light, and a risk of defects in material and centering. The front surface of such a glass mirror

* These are not the largest achromatics in existence; but Alvan Clark's grand $18\frac{1}{2}$-inch object-glass, valued at £2237, remains on the maker's hands in consequence of the war in America; and of the performance of Mr. Buckingham's, of 20 inches, the tube of which was so conspicuous in the International Exhibition, I have met with no detailed report. Mr. Craig's, at Wandsworth, of two feet, is well known to have proved a failure. No mention has been made of the very ingenious construction called the "Dialyte," well known on the Continent, because it has not, hitherto, attained such large dimensions.

† A large mirror of Herschel I. was broken merely by the frost; and the Earl of Rosse found that the same result would follow from melting cold resin upon a hot speculum, or touching it, when cold, with an iron tool but little warmer than itself.

would be free from all these objections were it coated with metal (for its own reflective power would be quite inadequate, except as a "helioscope," for viewing the sun); but then that alloy would be worthless, as it would take no polish in contact with the air. But it has been known for some years among chemists that by the addition of certain essential oils to a solution of nitrate of silver while it is undergoing decomposition by ammonia, the pure metal is precipitated on the surface of glass in the state of a film, so thin as to be feebly transparent to a powerful light, yet so firm as to receive a superb polish, and so reflective as to return, when compared with the best speculum metal, nearly *half as many again* of the incident rays. The applicability of this discovery to telescopes was perceived by Steinheil, of Munich, the ingenious rival of the great Frauenhofer's successor, Merz, in 1856; and in less than twelve months afterwards, independently, by M. Léon Foucault, of Paris. The former has advertised telescopes on this construction up to nine and a-half feet focus and twelve and three-quarter inches aperture; the latter has wrought a similar aperture to such a degree of excellence as to divide the well-known test, the companion of γ *Andromedæ*; and repeated notices may be found in the present work* of a still more magnificent instrument, of about thirty-one inches, from the same hand, worthily entrusted to the care of M. Chacornac, at the Imperial Observatory of Paris.

The numerous advantages of this construction will be readily apparent:—1. Large discs of glass may be cast much more free from pores and minute defects than corresponding masses of metal. 2. With an equal aperture they need not have more than one quarter of the weight; a very important consideration when we bear in mind the unwieldiness of very large instruments, and that the six-feet metallic speculum of the Earl of Rosse weighed no less than four tons. 3. They will be far less liable to change their figure in consequence of their own weight, or of any accidental strain or pressure; a matter of great consequence, as we find, from Sir John Herschel's statement, that an eighteen-inch speculum, two inches thick, was totally spoiled by supporting it on three points at its circumference, or by making it recline against a piece of wood, with a single thin packthread interposed down the middle, and Lord Rosse's experience, that even six inches of thickness, with six feet in diameter, would not secure correctness of figure, under a strong pressure of the hand. 4. They possess an inestimable advantage in being always renewable without injury. Should the surface of metal become tarnished, the defect can only be remedied by repolishing, a process which, except in the most accomplished

* Intellectual Observer, iv. 324; v. 380; vi. 481; xii. 420.

hands, is always attended with some risk of injuring the accuracy of the figure, and which, in those rare cases where extraordinary perfection is accidentally attained, would hardly be ventured upon at all; while, on the contrary, the silver coating may be removed or replaced at pleasure without in the least affecting the form of the glass, which, when once brought by repeated trials to the highest excellence attainable by art, will remain unchanged (provided the material itself is sound) for any assignable length of time. 5. The reflective power of the silver film is not only far greater than that of the most perfect speculum-metal, but the amount of light, with equal apertures, if we may trust the results of Steinheil's investigations, actually surpasses that of many achromatics—his numbers expressing the proportion of available light being, for the ordinary reflector (front view, as it would appear), 67·18; for Frauenhofer's achromatics, 76·0; for his own, 86·67; for the silvered mirror, 91·08, which the addition of a reflecting prism, on the Newtonian arrangement, might probably reduce to 84·4, or 79·0, according as we adopt the transmissive power of Steinheil or Frauenhofer's glass—at a mean somewhere about 81·7, a degree of brilliancy nearly half-way between the achromatics of Frauenhofer and Steinheil.

It would have been a mortifying conclusion to such an enumeration of advantages if we had been obliged to add that this beautiful invention was not merely due to foreign ingenuity, but was monopolized by foreign manufacturers. This, however, is not the fact. We shall not be long indebted for our knowledge of it to the small specimens, about four inches in diameter, which are sent over to England, by Sécrétan, the successor of Lerebours, at Paris, and sold in London by Negretti and Zambra. M. Foucault has, with praiseworthy liberality, published every step of his process in the *Annales de l'Observatoire Imperiale*, tom. v.; but other methods, it is found, will lead to the same result, and several of our countrymen are engaged in the pursuit, with an intelligence and perseverance which are sure to be rewarded in the end. It is now some time since it was stated that Mr. Hodgson (the observer of the brilliant spot in front of the sun) had communicated his experience to the Astronomical Society; and at the present moment Prof. Frankland, of the Royal Institution, the Rev. H. C. Key, of Stretton Rectory, Herefordshire, Mr. With, of Hereford, and Mr. Bird, of Birmingham, may be named as having made considerable progress towards complete success. In a future number we hope to lay some of their results before our readers.

OCCULTATIONS.

Besides that of 5 Cancri on March 1st, introduced into the list of last month, we have only two to indicate at convenient times. March 2nd, *a* Cancri will be occulted from 11h. 49m. till 13h. This will be interesting from the large size (4 mag.) of the star. The other is on March 30th, when ω Leonis, 6 mag., will be hidden from 11h. 44m. till 12h. 53m.

THE ANTIQUITY OF MAN.

THOSE who have elevated their minds to the faintest approximate conception of the boundless diversity and complexity which the universe displays in the combination of its materials and forces, will be prepared to expect that research will continually conduct them to surprise. The widest generalizations to which science has attained embrace so small a portion of the majestic whole, and so much of commonly received opinion rests upon no adequate foundation, that he can inquire little who does not continually meet with facts that cannot be accommodated to the hypotheses he has entertained; nor can we have a better test of the degree of cultivation of an individual, or of a society, than is afforded by examining the amount of readiness that exists to exchange old prejudice for new truth. Barbarous ages stone their prophets, because it is the tendency of ignorance to imagine that it is infinitely wise. It remains for intelligence to perceive its own feebleness, and for the loftiest reason to be the most convinced that it must fall short and fail to reach "the portals of Divinity," whether the subject of its contemplations be the work of creation in the physical history of a planet, or the functions and destiny of a mind. Where knowledge is obviously incomplete, belief should be provisional, and the judgment trained to hold itself in the prudent suspense of philosophic doubt, while the inquiring faculties are busy collecting the materials on which a final decision may be ultimately formed.

For some years past geologists have acted prudently in their treatment of the accumulating evidence of the antiquity of the human race. They have opposed a moderate, but not a fanatical, resistance to the incursion of new ideas. They have subjected every known fact bearing upon the question to a rigorous investigation, and they have not invited the general public to share their speculations until they rested upon so firm a basis that, although certain details were disputed, the

general bearing of the argument could not be gainsaid. If the last generation had been aware that any body of men were engaged in so formidable an attack upon prevalent ideas, a prodigious outcry would have been raised; but in our time the process has been allowed to go on quietly, partly because every other body of intelligent searchers into the history of the past has been led to analogous conclusions, and partly because there is happily less disposition than formerly to battle with truth as an enemy, before receiving her as a friend. Palæontologists and physiologists have made increasing drafts upon the bank of Time to enable them to trace the changes which organized beings have undergone; ethnologists have demanded the lapse of long ages to explain the phenomena of the modifications of race; and the new school of scientific historians have referred the civilization of early empires to periods far more distant than the epoch which was once thoughtlessly assigned to the creation of the world.

The geologist can do little in estimating the exact number of ages that have elapsed since the flint implements were fashioned by the savages in the valley of the Somme, but he can show those antique representatives of humanity to have been associated with animals that became extinct long before the earliest known works of Egypt were constructed, and to have lived at a time when the physical conformation of the globe's surface was widely different, not only from what it is now, but what it was in any pre-historic age of which tradition has preserved the faintest trace. It may be asked why no proof of these facts was obtained before the present day; how it happened that the innumerable excavations of man, or the natural cuttings by rivers, or seas, did not unrol the records of the human past? and the answer is easy. The geological record resembles rather stray leaves than a perfect book; it is only in rare and exceptional cases that nature preserves in her stone cabinet the relics of organic beings, and it is only a very few of the total number of her preparations, or, to preserve our metaphor, of the drawers containing her collections, to which access has been allowed. Our knowledge of specific forms is often derived from a single formation of very limited extent, and as an instance of what may unexpectedly turn up, we may remark that thousands of fossils have been extracted during several generations from the Solenhofen quarries without the slightest indication that they would one day surrender the extraordinary bird-reptile, or reptile-bird, figured and described in the last volume of this work. It must also be considered that many intimations of man's antiquity were of little value until others had been obtained. A single fact is often dumb when a group can be made to speak.

XUM

The long-announced and long-expected work of Sir Charles Lyell* has admirably brought to a focus the scattered information concerning our early progenitors, and it is still further enriched by the details of his own researches, and the careful reasoning of his own capacious and prudent mind. As Sir Charles Lyell observes, the only formations concerned in the present inquiry are those of the most modern date, or Post-tertiary; and he remarks, "It will be convenient to divide these into two groups—the Recent and the Post-pliocene. In the Recent we may comprehend those deposits in which not only all the shells, but all the fossil mammalia are of living species; in the Post-pliocene those strata in which, the shells being recent, a portion, and often a considerable one, of the accompanying fossil quadrupeds belongs to extinct species." The human remains of the Recent period, which form the subject of discussion, have been found in Danish peat mosses, in the beds of Swiss lakes, in certain artificial islands in Ireland, in Scotland, and various other parts of the globe, while those of the earlier epoch belong to Belgium, Germany, France, and England.

The peat bogs of Denmark have been formed in depressions of the drift formation, and they contain trunks of the Scotch fir often three feet in diameter, "which must have grown on the margin of the peat mosses, and have frequently fallen into them. This tree is not now, nor has ever been in historical times, a native of the Danish islands, and when introduced there has not thriven." It further appears to have been supplanted by the sessile variety of the common oak, which has been in its turn replaced by the beech. Thus, extensive changes in the vegetable world, resulting from alterations of soil and climate, must have taken place since the Danish savages lived, who made the rude implements of the stone period that are discovered in the bogs.

Another class of objects in Denmark, the "shell mounds," offer their testimony to the antiquity of the rude hunters and fishers by whom they were formed. The Danes call these accumulations "kitchen heaps." They are, in fact, the refuse of pre-historic dinners, and are associated with "flint knives, hatchets, and other instruments of stone, horn, wood, bone, and fragments of pottery." The "most conclusive proof" of the antiquity of these heaps is found in the character of the imbedded shells. At present, the quantity of fresh water poured into the Baltic is so unfavourable to oysters, cockles, mussels, etc., that they are either dwarfed or entirely excluded from that inland sea; but the old fishermen were able to obtain large specimens in great quantities, which shows a dif-

* *The Geological Evidences of the Antiquity of Man, with Remarks on Theories of the Origin of Species by Variation.* By Sir Charles Lyell, F.R.S. Murray.

ferent condition in the physical geography of the locality, so as to permit a freer access to the salt water of the ocean than now occurs. The shell mounds correspond in date, says Sir C. Lyell, with the earliest part of the age of stone, as known in Denmark. Later than this comes the so-called age of bronze, and that must have been very ancient in a chronological point of view.

The ancient lake dwellings of Switzerland were the abode of a race who built their habitations on piles surrounded by water. Some remains of this class belong to the stone period, and others to the bronze. Among the profusion of relics of these singular people is a human skull of the early stone period, and much like those belonging to the Swiss of the present day. All attempts to convert geological time into its chronological equivalent must be received with caution, but Sir C. Lyell attaches some weight to the calculations of M. Morlot, who, "assuming the Roman period to represent an antiquity of from sixteen to eighteen centuries, assigns to the bronze age, as disclosed in a delta of the Tinière, a date of between 3000 and 4000 years, and the oldest layer (of the same formation), that of the stone period, an age of from 5000 to 7000 years."

Passing over researches in Ireland, Egypt, and Brazil, we come to the delta of the Mississippi, to which Sir C. Lyell assigns an antiquity of probably more than 100,000 years. At a certain depth in this formation a human skull was discovered of the type of the red Indian race, and to this Dr. Dowler ascribes an antiquity of 50,000 years. In the coral reefs of Florida human bones were found by Count Pourtalis, in a conglomerate, calculated by Agassiz to be 10,000 years old.

The reader who desires to see a more perfect chain of evidence than we have adduced in the preceding paragraphs, to show that man lived in a period which, although geologically very modern, is still chronologically extremely old, is referred to Sir C. Lyell's work, from which we proceed to extract proofs that the human family may be traced back to a still earlier time, when certain mammalia that are now extinct inhabited the earth. In 1833-4, Dr. Schmerling published an account of his researches in caverns near Liège, which led to the discovery of human bones associated with the bones of the cave bear, hyæna, elephant, and rhinoceros, which are extinct, and with other bones of animals still extant. In the Engis cavern a human skull was found embedded by the side of a mammoth's tooth. This skull was so fragile that it could not be preserved, but a more fortunate specimen, now in the museum of the University of Liège, was dug out of a breccia at the depth of five feet, and was associated with the tooth of a rhinoceros, the

bones of a horse, and other animals. Other caves likewise yielded human remains; but Dr. Schmerling remarked that out of about forty which he explored, flint implements were universal, although human bones were the exception. These discoveries did not attract the attention which they merited, because few geologists were disposed to modify their ideas on the antiquity of the human race, or to admit the fact that the comparative date they had been pleased to assign to it rested upon no adequate support.

In 1860 Sir C. Lyell visited the scene of Schmerling's investigations, and found that the caves of Engis, Chokier, and Goffontaine had been completely destroyed: part of the Engihoul cavern, however, remained, and it was explored by our distinguished countryman in company with Professor Malaise. They soon found bones and teeth of the cave bear and other extinct quadrupeds, and the continuance of the examination by Professor Malaise was rewarded in a few weeks by the discovery of three fragments of a human skull, and two perfect lower jaws with teeth, at a depth of two feet below a crust of stalagmite, and again associated with the bones of extinct animals.

The antiquity of such remains must be computed by estimations of the time which must have intervened between the period when certain races of animals were common and that at which they became extinct, and also by the ages required to produce considerable changes in the configuration of the country, as under existing circumstances the caverns could not have been, as they once were, the receptacles of materials carried along and rounded by streams or floods. Some of the fossiliferous caverns "now open in the face of perpendicular precipices, 200 feet in height above the present streams," and there are other evidences of such extensive alterations as to leave no doubt that an immense lapse of time is required to account for them, even with the aid of the probable supposition that disturbing agencies were far more active in some former period than at the present time. Sir C. Lyell makes no attempt to say how long ago the ancient Belgians flourished, but he observes that "although we may be unable to estimate the minimum of time required for the changes in physical geography above alluded to, we cannot fail to perceive that the duration of the period must have been very protracted, and that other ages of comparative inaction may have followed, separating the Post-pliocene from the historical period, and constituting an interval no less indefinite in its duration."

The next instance cited by Sir C. Lyell refers to the fossil human skeleton found in 1857 in the cave of Neanderthal, near Düsseldorf, about seventy miles N.E. of the Liège caverns.

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The Neanderthal cave is sixty feet above the level of the river Düssel, and 100 feet below the surface of the country, with which it communicates by a rent, forming an ascending channel. Professor Huxley pronounced the skull obtained from this cave to be the most ape-like he had ever beheld. The last-named Professor observes that "cranial measurements alone afford no safe indication of race," and he shows that the skulls of Australian savages prove that great differences of development may co-exist in a race that is remarkably pure and unmixed. Sir Charles Lyell remarks that the Engis skull has caused surprise, "because, being so unequivocally ancient, it approached so near to the highest, or Caucasian type; that of the Neanderthal, because, having no such decided claims to antiquity, it departs so widely from the normal standard of humanity."

Human remains in Brixham cave and other places combine to enforce man's claims to a part diuturnity as an inhabitant of the globe, and as fresh evidence has been collected, attempts to give an opposite interpretation to geological facts have been received with diminishing favour, until there is not now any existing authority of eminence whose opinions could be cited against the general conclusions embodied in Sir C. Lyell's work. This result has been much accelerated by the discoveries of flint implements in the valley of the Somme; and although these researches have only attracted the very recent attention of the general public, they have been carried on for many years, and have successfully passed the ordeal of prolonged investigation and dispute.

Condensing Sir Charles Lyell's description of the locality, we find the valley of the Somme situated in a region of white chalk with flints, the strata of which are nearly horizontal, and the hills from 200 to 300 feet high. Ascending to that height discloses a table-land, in which the chalk is mostly covered by loam about five feet thick. A section of the valley shows the underlying chalk at the bottom, then a bed of gravel, on which lies twenty or thirty feet of peat. A gravel bed covered with loam rises on one side of the valley, a little above the peat, and still higher on both sides is an upper gravel bed, which, like the lower one, contains elephants' bones; above this an "upland loam," and still higher Eocene tertiary strata, resting on the chalk in patches.

The peat constitutes the most modern of the formations just described, and is about thirty feet thick. It abounds in mammalian bones, but "M. Boucher de Perthes has only met with three or four fragments of human skeletons." So large a mass of peat, whose formation is always very slow, must have occupied a lengthened period, and it was obviously formed after the

deposits in which the flint implements have been found. At Menchecourt, Abbeville, many flint implements have been found in a position which Sir C. Lyell explains by a diagram. First we find a hollow in the slope of the chalk, exhibiting a "bed of brown clay with angular flints and occasionally chalk rubble, unstratified, probably of sub-aerial origin, of very varying thickness, from two to five feet and upwards." Below this comes a calcareous loam, containing fresh water and land shells, with bones of elephants, etc.; thickness about fifteen feet." Underneath this "alternations of beds of gravel, marl, and sand, with fresh water and land shells, and in some of the lower sands a mixture of marine shells; also bones of elephant and rhinoceros, and flint implements; thickness about twelve feet. At a lower level in the valley is the bed of gravel on which the peat rests, separated by a thin bed of impervious clay. The age of this gravel and its precise relation to that in which the flint implements were found is not ascertained.

In such a case as this the age of the flint implement deposit must be estimated with reference to the amount of natural work that has been done in the locality since its formation, and the evidence will be partly derived from the thickness and character of the strata deposited upon it, partly from the quantity of matter that must have been removed to give the valley its present appearance, and partly from the extent of changes which fossil remains prove to have occurred in organic life. Into this calculation we cannot enter, but history and observation show that alluvial formations are of such slow growth that many centuries count for little when extensive changes have to be explained.

No one having the slightest acquaintance with geological facts would deny the enormous antiquity, chronologically speaking, of the flint implement deposits of the Somme; but two important objections have been made. It was said that the so-called implements were natural fragments of flint, and that if their shape was due to human skill, some accident had deposited them in a stratum older than themselves. Both these difficulties have been met; archæologists and geologists are now agreed that they are veritable works of man, and repeated examination precludes the idea of their being modern productions accidentally misplaced. Professor Ramsay observes, "for more than twenty years, like others of my craft, I have daily handled stones, whether fashioned by nature or art; and the flint stones of Amiens and Abbeville seem to me as clearly works of art as any Sheffield whittle." We ought to add that Mr. Prestwich, who is remarkable for his acquaintance with formations of this kind, obtained, as did others, conclusive evidence that the flint implements existed in undisturbed beds

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of gravel, and had not made their way into them from any newer deposit. England has yielded flint implements like those of the Somme: some have been found in the basin of the Thames, but their geological position has not been made out; and others occur in the gravel pits of the valley of the Ouse, near Bedford, and certain localities in Suffolk.

We have thus given a very incomplete summary of the geological evidence on which a far greater antiquity is claimed for man than a guess-work system of modern chronology has assigned to him, and it is remarkable that the science of modern Europe is thus rescuing from ignominious treatment the historical traditions of ancient races, and restoring them to their true place, as more or less reliable contributions to our acquaintance with the distant past. In France M. Rodier* has endeavoured to make astronomy the means of testing and estimating ancient dates, and he affirms that the Egyptian period of Osiris is approximately proved to coincide with 19,564 B.C., and the era of Ma he considers shown by "very precise astronomical indications" to have commenced in 14,611 B.C. We offer no opinion as to the validity of M. Rodier's process, but his work is one of many indications of a disposition to collate and respect the teaching of long neglected facts, and however far back his calculations may place the dawn of civilization on the banks of the Nile, it will still appear as a modern period when compared with the epoch during which England was united with France, and the men of the flint implements contended with wild beasts whose race has been long extinct.

Each mind must decide for itself how far its speculative opinions may be affected by these considerations; but, as Sir Thomas Brown observed with reference to his own scientific inquiries, "there is no danger to profound these mysteries, no *sanctum sanctorum* in philosophy: the world was made to be inhabited by Beasts, but studied and contemplated by Man; 'tis the debt of Reason we owe to God, and the homage we pay for not being Beasts. . . The wisdom of God receives small honour from these vulgar Heads that rudely stare about, and with gross rusticity admire his works; those highly magnify Him whose judicious inquiry into his Acts and deliberate research into his Creatures return the duty of a devout and learned admiration."†

* *Antiquité des Races Humaines, Reconstitution de la Chronologie et de l'Histoire des Peuples Primitives, par l'Examen des Documents Originaux et par l'Astronomie.* Paris, Amyot.

† *Religio Medici*, ed. 1686, p. 7.

PROCEEDINGS OF LEARNED SOCIETIES.

BY W. B. TEGETMEIER.

GEOLOGICAL SOCIETY.—*Jan.* 21, *Feb.* 4, *and* 20.

On the Parallel Roads of Glen Roy.—Professor Jamieson read a paper on the formation of these roads and their position in the history of the Glacial period.

After describing the general appearance of the roads, the author referred to the different theories that have been framed to account for them, giving his reasons for considering both the marine hypotheses untenable, and pointing out the evidences in favour of Agassiz's theory of a dam of glacier-ice having supported a fresh-water lake. He especially dwelt upon the coincidence between the height of each of the parallel roads and that of a neighbouring water-shed, but also remarked upon the objections to a glacial barrier, explaining how it might have shrunk at three successive periods, so as to allow of the formation of the three roads. He then showed that the period of the formation of these roads must either have been posterior to that of the chief submergence of the drift-period, or that the sea did not reach them during the submergence; also, that it was prior to the formation of the 40-feet raised beach of Argyleshire.

Professor Jamieson concluded by stating that his examination of Lochaber had led him to infer that the parallel roads are the beaches of ancient fresh-water lakes, which arose from glaciers damming the mouths of the valleys and reversing their drainage, at a date subsequent to that of the great land-glaciation of Scotland, owing to a re-extension of the glaciers after the chief submergence of the Drift period.

On a Hyæna-den at Wookey Hole, near Wells. By W. Boyd Dawkins, Esq., B.A., F.G.S., of the Geological Survey of Great Britain.

The former partial exploration of this cave by the author convinced him of the desirability of a more rigorous examination, the details of which were given, showing the distribution of the teeth and bones of the species of *Mammalia* whose remains were met with in the several parts of the cave, and a statement of the general results arrived at. A consideration of the distribution of the remains in the cavern and their close juxtaposition to the roof, coupled with the fact that the flint and chert implements discovered were found in much lower positions, led Mr. Dawkins to infer that the bones had been dragged in by hyænas, and that the cave had been subjected to periodical inundations of waters laden with red mud, whereby the bones had been elevated by degrees until they occupied their present position.

The Anniversary Address was delivered on the 20th February, by the President, Professor Ramsay, the subject being the "Breaks

in the Succession of British Strata." The remarks were chiefly directed to the Palæozoic formations, and evidence was adduced to show that the epochs not stratigraphically represented in our islands were of longer duration than those which are so represented. From these premises the Professor argued that the apparent breaks in the succession of living forms were to be accounted for by the incompleteness of the record, and not by theories of violent destructions and new creations, which were not borne out by known facts. Nor was it just to assume that we saw the dawn of life in the earliest British strata, especially as older corals had been discovered in Canada.

Professor Ramsay likewise adverted to the question of whether similar formations in distant countries were contemporaneous, and stated his opinion that in many cases the length of time occupied in the disposition of Palæozoic strata was so enormous as to have rendered a very wide migration of species possible, and to make it probable that similarity of organic remains indicated an approximation of date.

ROYAL GEOGRAPHICAL SOCIETY.—*Jan.* 26.

The first paper, "On a Proposed Route to Siam, China, etc., across the Isthmus of Kraw, by Captains Fraser and Forlong," was communicated by Dr. Duncan Macpherson, F.R.G.S., etc., etc. The paper set forth the advantages to be derived by constructing a railway through the neck of land in the Malay Peninsula, known as the Isthmus of Kraw. The saving in time between Calcutta and Hong-Kong by this route would be ninety-three hours; and fifty-six hours would be saved from Ceylon to Hong-Kong; touching at four ports, viz. Akyab, Rangoon, Moulmein, and Kraw: while coasting it from Calcutta to Hong-Kong, thirty-four hours will be saved over the present route, viz., Singapore.

From Ceylon to Kraw, and thence direct to Calcutta, *two extra* English mails may be carried in nine and a half days to the mouth of the Hooghly, necessitating only one extra steamer between Ceylon and Aden, to meet the Bombay mail.

Mr. John Crawfurd observed that the so-called Patchkau River, which was said to be navigable for fifteen miles, was simply an estuary of the sea, with a depth of four or five fathoms for half the distance, and of but a fathom and a half for the remainder. Then at the eastern terminus of the proposed railway there was no harbour, and the shore was moreover exposed to the north-eastern monsoon. With these disadvantages the route in question would never serve as the transit for the great trade between Europe, India, and China. Nor, if practicable, would the small saving of time to be gained justify the great outlay that must be incurred. In reply to the alleged dangerous navigation of the Straits of Malacca, Mr. Crawfurd stated that during a period of eighteen years, the Peninsula and Oriental Company had lost only two ships in the Straits, and that arose from a collision in the dark; that out of three hundred voyages made by steamers from Calcutta and Bombay, not a single vessel had

been lost; and that no instance had occured of the loss of any of her Majesty's steamers, nor of any of the vessels despatched fortnightly by the Dutch Government, which had passed through these Straits.

Mr. Lawrence Oliphant, F.R.G.S., then read his paper on the Island of Tsusima, Japan. After a short allusion to the inland sea of Japan, Mr. Oliphant gave an account of a visit to Tsusima, an island lying midway in the Straits of the Corea. Fatchiu, the capital, contains 10,000 inhabitants. The Prince's palace is situated near the town. He is absolute proprietor of the island, and has a monopoly of the transit trade between the Corea and Japan, which consists chiefly in tigers' skins, hides, rice, silver, and gold. The island is about forty miles long, from eight to ten broad, and contains a population of 30,000. It is hilly, the highest peaks attaining an elevation of upwards of 2000 feet; they are heavily timbered. The island is almost bisected by a deep sound, from which numerous deep fiords diverge. The fleets of the world might be concealed in this labyrinth of inland waters. As yet our knowledge of the interior of the island is very limited. Its position between Corea and Japan renders it important.

Sir Rutherford Alcock stated that the island of Tsusima was of some interest to him when he was in Japan, from the proceedings of the Russians in that quarter. It was known that they had for some time made it a sort of naval port for carrying out most extensive repairs to their ships; and it was therefore desirable to ascertain whether the island enjoyed advantages which might be fairly shared by other nations. The reports which had been received convinced him that there is no part of the Chinese seas which could be chosen with so much advantage as this magnificent harbour in an unfrozen sea, capable of being made defensible against attack, and of serving as a place of resort for fleets in distress. Sir Rutherford dwelt particularly upon the extraordinary accuracy of the Japanese maps and charts.

The President called attention to the reported death of Mr. Consul Petherick and his wife on the White Nile, and after expressing the deep regret which every geographer must feel at the death of these travellers, stated that the money which remained out of the subscriptions raised to enable assistance to be sent to Captains Speke and Grant, the Council had resolved to place in the hands of Mr. Baker, who was about to proceed into the interior from Khartum at his own expense, and to request him to pursue the expedition with which Mr. Petherick had been entrusted.

ETHNOLOGICAL SOCIETY.—*Feb.* 3.

On the Psychological Differences which Exist amongst the Typical Races of Man, by Robert Dunn.—The author maintained that genus *homo* was distinctly defined, on the ground that in man's moral and religious attributes the inferior animals do not participate, and it was this that constituted the difference between

him and them. The barrier was thus, he considered, impassable between man and the chimpanzee and gorilla; and that wherever man, with his erect attitude and with his articulate voice, is found, his claims to our common humanity must be immediately acknowledged, however debased the type may be. His conviction was that there was proof of a general unity exhibited in all the races of the great family of man, inasmuch that they were all endowed with the same intellectual faculties and mental activities, however much they may vary in degree. It had, he thought, been fairly argued that all the races of the human family form but one species, from the physiological fact that they are all capable of fruitful union. Believing the brain to be the material organ of the mind, the author considered the study of the cerebral organization and development in the various typical races as one of the most effectual means of better understanding and elucidating the psychological differences which characterize them. This subject, however, was one that yet required to be worked out; and ethnic psychology was still a desideratum. The author then reviewed what had been done by anatomists and ethnologists, and pointed out that the lower savage races, such as the Sandwich islanders, made progress in the early part of their education, and were so far as apt and quick as the children of civilized Europeans; but at this point they stopped, and seemed incapable of acquiring the higher branches of knowledge. The Sandwich islanders have excellent memories, and learn by rote with wonderful rapidity, but will not exercise the thinking faculties; they receive simple ideas, but not complex ones. In like manner it was found practically that negro children could not be educated with white children. In all these cases, as well as in the minor ones continually occurring amongst ourselves, of inability to understand subjects and reasonings of a certain order, the true explanation is that the cognate faculties have not reached a complexity equal to the complexity of the relations to be perceived; as moreover it is not only so with purely intellectual cognitions, but it is the same with *moral* cognitions. In the Australian language there are no words answering to justice, sin, guilt. Amongst many of the lower races of man, acts of generosity or mercy are utterly incomprehensible; that is to say, the most complex relations of human action in its social bearings are not cognizable. This the author thought was in accordance with what *à priori* might have been expected to have resulted from organic differences in the instruments of the higher psychical activities—or, in other words, in the nervous apparatus of perceptive and intellectual consciousness. The leading characters of the various races of mankind were simply representatives of particular stages in the development of the highest Caucasian type. The negro exhibits permanently the imperfect brow, projecting lower jaw, and slender bent limbs of a Caucasian child some considerable time before the period of its birth. The aboriginal American represents the same child nearer birth; the Mongolian the same child newly born.

LINNÆAN SOCIETY.—*Feb.* 5.

On the Existence of the Two Forms in some Species of Linum.—A paper by Mr. C. Darwin was read, on the existence of two forms in several species of the genus Linum. In the Linum grandiflorum these two forms occur in about equal numbers; in general appearance both are alike, but closer examination shows that in one the styles are short, and diverge to such an extent that they are thrust out between the filaments, not being long enough to reach the anthers. In the other form the styles are very much longer, and stand perfectly erect, occupying the centre of the flowers. So far as can be ascertained by microscopic examination, the pollen of both forms appears identical in structure. In the year 1861, eleven plants of Linum grandiflorum were growing in Mr. Darwin's garden; of these eight were long-styled and three short-styled. Of the long-styled plants it was ascertained that when the stigmas were covered with pollen from long-styled flowers, they invariably remained sterile, but that when fertilized with pollen from the short-styled variety, they produced abundance of seeds. Of the short-styled form it was found that they were rather more fertile with their own pollen than the long-styled; but it was thought possible that this might be dependent on pollen from the long-styled flowers being conveyed by means of the small dipterous insects that frequent the species. In the year 1862, Mr. Darwin experimented on plants which were protected from insect agency. Fourteen long-styled flowers fertilized with short-styled pollen, produced eleven perfect capsules. Whereas one hundred long-styled flowers, fertilized with pollen from the same form, produced only three capsules, and these were imperfect.

In the short-styled form, of twelve flowers impregnated with pollen from the long-styled variety, seven produced perfect capsules containing seeds, as contrasted with one hundred with their own pollen, of which only eleven produced seed. Thus it appears that there is a slight difference between the two forms, the long-styled being perfectly sterile with its own pollen, whereas the short-styled is only partially so. Microscopic examination and dissection show that when the pollen grains from the short-styled variety are placed on the stigmas of the long-styled flowers, they burst in about five or six hours, and emit long tubes, which can be traced down the tissue of the style, and that in about twenty-four hours the stigmas wither, showing that their function has been fulfilled. When, however, the pollen of the long-styled flowers is placed on stigmas of the same form, only a very small number of the grains burst, and the tubes emitted by them do not penetrate more than a very short distance into the tissue of the stigma. Thus it appears that the stigma of each variety is perfectly powerless over pollen of the same variety, but that simple contact with the stigmatic surface causes the pollen of the opposite form to emits its tubes.

It would be difficult to overrate the value of the contributions with which Mr. Darwin has lately enriched Botanical Science. The present

is of immense value, not only for the positive information which it affords on a subject altogether so novel and interesting, but also because it shows young naturalists how much may be done in the study of the simplest and most common organism, provided this be carefully and conscientiously carried out. To those botanists who believe that botanical science consists in a mere knowledge of the names of numerous species, and that it is to be mastered by merely collecting and cataloguing plants, we commend the recent investigation of the illustrious author as an example worthy of all imitation.

SOCIETY OF ARTS.

A pressure upon our space has prevented our giving earlier notice to Mr. Highley's lecture at the above Society on "The Application of Photography to the Magic Lantern Educationally Considered." The object was to exhibit the excellent apparatus and slides prepared for the illustration of lectures on a variety of subjects. Mr. Highley explained his mode of procedure at considerable length, and obtained much applause for the merit of his results. His arrangements for a portable oxy-hydrogen microscope particularly deserve commendation.

Mr. Highley has since opened the Burlington Gallery, 191, Piccadilly, for the display and sale of his photographic slides. We were present on the first evening, and were especially pleased with some admirable instantaneous vews of Paris, and Kaulbach's scenes from Reynard the Fox. Some of the scientific representations were very good, but photography is only partially successful in giving the textures of rocks, and Dr. Maddox's diatoms are unsatisfactory.—[Ed. *I. O.*]

ROYAL INSTITUTION.—*Feb.* 13.

On Artificial Illumination.—Dr. Frankland in his lecture on the Artificial Illumination, described the formation of the new compound, *Acetylene*, which is produced when coal gas is highly heated. This is strongly illuminating, and is interesting as forming an explosive compound with copper; thus explaining the cause of the mysterious explosions that have not unfrequently occurred when coal gas is passed through copper tubes. In speaking of the economy of the different illuminating agents, Dr. Frankland stated that by recent experiment he had ascertained that one gallon of mineral oil was equal to 18 pounds of paraffin candles, 22 pounds of sperm, 26 of wax, 27 of stearine, 29 of composite, and 39 pounds of ordinary tallow candles.

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NOTES AND MEMORANDA.

NERVES OF THE LIVER.—We see from the *Proceedings of the Royal Society* that Dr. Lee has demonstrated that all the arteries—even the most minute—which ramify in the liver, are accompanied by nerves which take their origin from ganglia round the root of the hepatic artery, and which are intimately connected with, or form part of, the semi-lunar ganglion of the great sympathetic.

SOLVENT FOR SILK.—M. Persoz describes in *Comptes Rendus* his process for dissolving silk. He uses a concentrated solution of chloride of zinc, which has been boiled with an excess of the oxide of that metal until it does not discolour litmus. By means of Professor Graham's dialyser, the silk can be separated from the chloride of zinc, in the form of a colourless, inodorous solution, which gives an evaporation, a green-coloured brittle varnish. The chloride of zinc offers the means of separating the silk from mixed fabrics.

PLASTICITY OF BLOOD CORPUSCLES.—Dr. Sharpey says:—"The plasticity of the blood corpuscle is unrivalled by any other physical body. It will assume all sorts of protean shapes under the slightest influences. Elongating to a mere thread, it will pass through a narrow chink; it will wrap itself round an acute projecting angle, or protrude feelers and tails under the influence of currents. In its natural state, it possesses sufficient elasticity to resume its original shape on the cessation of the modifying influences; but when gum or gelatine has been added, or when the plasma has been permitted to thicken spontaneously, the corpuscle retains any form it may have assumed till again altered by fresh influence."—*Proceedings of the Royal Society*, No. 52.

BLACK RAIN IN SOUTH AMERICA.—(From the *Mercurio* of Valparaiso, December 17, 1862.)—A strange phenomenon has been seen in one of the Argentine Provinces. The *Comercio del Parana* describes it as follows:—"On the 12th inst. (December), about seven A.M., it became so dark that in many houses in this city (San Juan) lamps had to be lighted; it soon began very slowly to clear up, but the day remained cloudy till about two p.m., accompanied by strong gusts of wind. During the night it rained *black water*. Some tubs that had remained out of doors were found next morning filled with muddy and very dirty water." A letter we have before us, says:—"Since the 7th of December it had been raining at intervals of half an hour. On the 12th, tubs were found in the morning filled with black water, remainings of the rain we had last night. There are persons who assert that it has rained until eight this morning, and that the same rain stained the clothes that happened to have been left out of doors to dry. There is no doubt that on the 12th December, 1862, it rained *black water*. The people of the district were very much alarmed, and the female portion began to pray fervently."

A VEGETABLE ANOMALY.—M. Alphonse de Candolle observes:—"*Quercus chrysolepsis*, *lutescens*, and *virens*, of the centre of the United States and of Mexico, are forms closely allied to the *Ilex;* but the *Q. virens*, whose fruit I have been able to examine, presented the singular character of having only one cotyledonous mass, instead of the two cotyledons of the Ilex. A profound difference may thus be masked under an uniform aspect."—*Archives des Sciences*, No. 60, p. 349.

FORMATION OF STRIPED MUSCULAR FIBRE.—Mr. J. Lockhart Clarke, F.R.S., writing in the *Quarterly Journal of Microscopic Science*, observes that in man the development of striped muscular fibre is on the same plan as in birds and mammals, but with certain points of difference. In the early stage the striking forms do not appear which are seen in the chick between the sixth and seventh days of

incubation, and in the sheep or ox at a corresponding period. From the fourth to the fifth week of utero-gestation is about the earliest period at which this tissue can be distinguished with certainty from some others. In a fœtus of three-quarters of an inch in length, it forms a gelatinous mass, consisting, as in the other cases described, of fibres and nuclei imbedded in a semi-fluid granular blastema. In the formation of these fibres granular processes of condensed blastema extend from the sides or from around the nuclei, and along the surface of these a new substance forms, until they become partially or completely invested." Mr. L. Clarke investigates the assertion that the formative bodies of striated fibre are true "nucleated cells," and remarks, "I think I may safely assert that in man, mammalia, and birds, the granular substance surrounding the nuclei, and concerned in the development of the muscular fibres, have no envelope or cell-wall in the proper sense of the word, and that these bodies are not entitled to be considered as nucleated cells." He adds, "however, there is little doubt that the muscular substance is the result of some process carried on by the nuclei themselves."

Reproduction of Æquorea vitrina.—Dr. Strethill Wright states in the *Quarterly Journal of Microscopic Science* that he received two live specimens of the above medusæ in November, one about three inches in diameter, and the other about six and a-half. "The number of lips of the latter was about forty, the radiating canals, each having a long double ovisac, about eighty, and the marginal tentacles, by estimation, four hundred." On examining the ovaries he found the eggs hatched, and the young, in the form of almost invisible planulæ, were issuing from the ovisacs. Some thousands were gently extracted with a glass syringe, and placed in tanks of clean sea-water. In three weeks about a score had developed into campanularian polyps, and about a hundred were progressing to that end, the rest having disappeared. The little planule fixed itself to the glass, secreted a "scleroderm," and put forth a polyp bud, which swelled day by day, and at last opened and displayed twelve attenuated tentacles, "joined together for about one-third of their length by a web, the polyp inclosed in a cell terminating in many acuminated segments." Dr. Wright considers the hydroid phase of Æquorea vitrina identical with that of Laomedea acuminata in shape, but so excessively small as to be invisible to the naked eye. He adds that the medusoids increase in the number of their elements, lips, tentacles, etc., as they grow, and he observes, "the question as to the larval state of Æquorea vitrina is settled. This, the largest of all the naked-eyed medusæ is the reproductive phase of one of the smallest of all the hydroidæ."

Pycnogons in Polyps.*—Dr. Strethill Wright, alluding to Professor Allman's discovery of the occurrence of pycnogon larvæ in certain vesicles of the Coryne eximia, and to similar observations of Mr. Hodge, with reference to hydractinia, states he has observed pycnogons in the latter zoophyte. Some of "the polyps appeared bloated and overgrown under the use of their pycnogon diet" when examined by Mr. Hodge; and Dr. Wright found a similar polyp, which contained three larvæ of a pale yellow colour, which seemed destitute of legs. As the development of the pycnogons proceeded, the polyp tentacles were absorbed, and the polyp became a long sac, pointed at its upper extremity, and fitting closely on the larvæ. He agrees with Mr. Hodge in imagining that the larvæ of the pycnogons are swallowed when very young by the polyps of the Coryne, and carried through the tubes of the cœnosarc until they arrive at a part which is about to become a polyp, which thereupon has its destination altered; but as the cœnosarcal tubes of the hydractinia are too small to admit of this process, "the pycnogon sacs in this zoophyte are formed, not by the arrest or change in development of an immature polyp, but by the degeneration of a tentacled polyp previously perfect." —*Quarterly Journal of Microscopic Science.*

Force of Waves.—*Cosmos*, speaking of the January storms, praises the admirable system of warning organized in England by Admiral Fitzroy, and then

* Pycnogons are small, odd-looking, eight-legged crustaceans common on our coasts.

proceeds to mention some instances of the force exerted by the waves during the prevalence of the unusual wind. Blocks of stone weighing thirteen tons were hurled to a distance of more than thirty feet, and blocks of three tons to more than one hundred yards. The outer harbour of Fécamp was destroyed, and the mass of earth torn from the north side of Cape la Hève was estimated at more than 300,000 square yards.

Spectra of Stars.—M. Secchi reports that by adjusting the pocket spectroscope of M. Jansen to his great equatorial at Rome, he obtained brilliant and beautiful results with many of the stars. The colours varied in different stars, as did the disposition and number of the dark lines. M. Jansen will publish a complete account of these investigations, but in the meantime M. Secchi states that α Orionis affords a very remarkable spectrum with numerous and notable interruptions.

Action of Sulphuric Acid on Lead.—Messrs. Calvert and Johnson state that sulphuric acid attacks pure lead more quickly than the same metal in an impure state—a result quite contrary to expectation.

Shooting-Stars and the Weather.—M. Heis, who has devoted much attention to shooting-stars, observes in *Cosmos* that the more the subject is studied the less cause there appears for imagining that these phenomena afford indications of coming weather.

Adhesion of Diatoms and Glass.—Mr. Gray has sent us a glass disk used for covering microscopic objects, to which specimens of Pleurosigma angulatum adhere so firmly that no friction with leather or silk will remove them. The diatoms were deposited from a drop of distilled water, and the adhesion does not arise from the action of any cement, but is apparently a case of the close contact of clean surfaces with strong mutual attraction. Some other diatoms behave in the same way.

Baker's Microscope Lamp.—Mr. Baker, the optician, has introduced a cheap and handy microscope lamp. It consists of a small, well-made, paraffin lamp of glass, attached by a spring clip to the arm of an upright stand, capable of adjustment to the height required. It is furnished with a shade, and being more carefully constructed than the common sort, it appears free from their defect, the escape of the paraffin through capillary attraction.

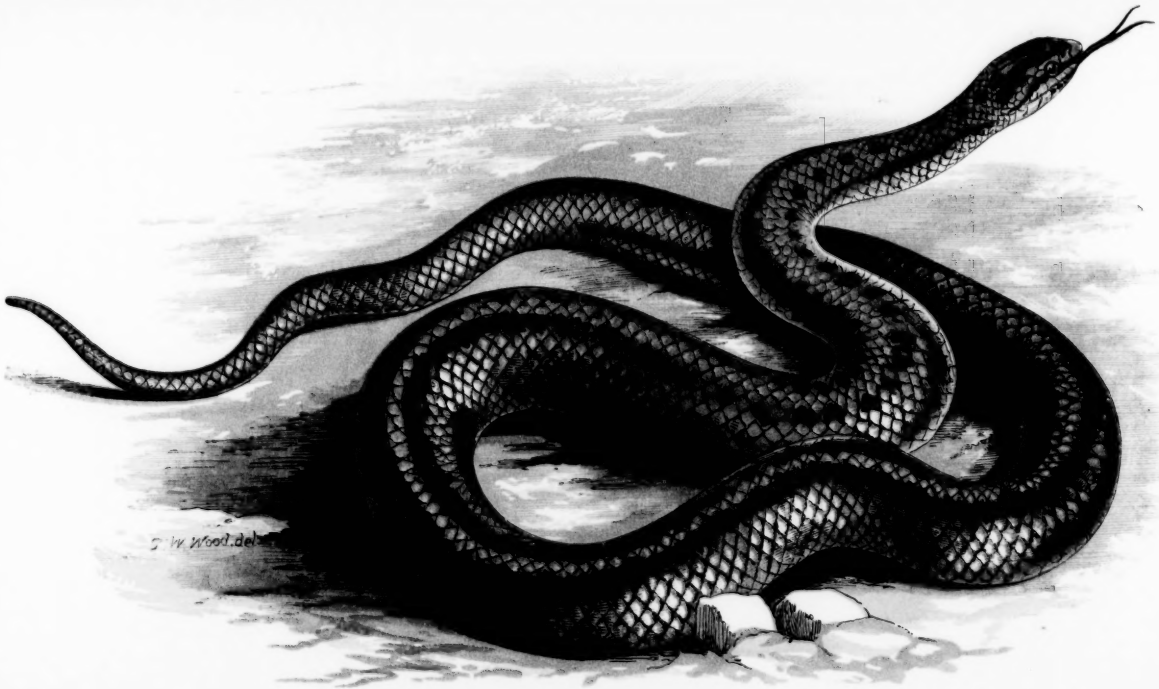
Variable Star Astronomy.—Notwithstanding the great advances made in this branch within the last few years, it may be said to be still almost in its infancy, and in it a rich and abundant harvest may be reaped by every diligent and careful labourer with the smallest telescope available for astronomical purposes. With the view at once of stimulating and aiding inquiry in this direction, it is proposed to form an association for the systematic observation of variable stars. The observations will be made, reduced, and discussed on a uniform plan, and as in their nature they present no peculiar difficulty, and require no special instrumental appliances, it is hoped that none will be deterred from joining the association through distrust of their own skill, or on account of any supposed deficiency in telescopic power. All who feel interested in the proposal are requested to forward their names and addresses to Joseph Baxendell, Esq., F.R.A.S., 108, Stocks Street, Manchester, or to George Knott, Esq., F.R.A.S., Woodcroft, Cuckfield, Sussex, when steps will at once be taken to prepare and furnish to the members a full account of the methods to be employed, and every endeavour will be made to remove any difficulties which may present themselves in practice.

Equipoise Telescope Stand.—Messrs. J. Parkes and Son, of Birmingham, having furnished us with a telescope stand bearing the above designation, we are able to speak confidently of its merits. Its great characteristic is a high degree of

steadiness when the deepest powers of a portable instrument are employed. The telescope is suspended by its centre of gravity, so that a slight friction on its axis renders it stationary. The head of the stand is of bronzed iron with fittings of brass, and has a movement by which its upper portion can be thrown forward, so as to permit the observation of zenith stars. The folding legs, of polished oak, are bound together by three metallic arms, which meet in a central plate that receives the lowest portion of an upright brass rod, the upper part of which is fixed to the head of the stand. This rod gives a firm support to an excellent vertical rackwork, and the head of the stand is furnished with a smooth and efficient horizontal motion, put in action by a handle with an universal joint. The appearance is handsome, and the weight not greater than is desirable to prevent vibration.

Gauss Telescope Glasses.—An article by M. Radau in the *Annuaire du Cosmos* for 1862, called our attention to the success obtained by Steinheil, of Munich, in constructing telescope object-glasses, on the principle embodied in the formula of the celebrated mathematician, Gauss. It was stated that an objective of the new kind possessed all the advantages which Gauss anticipated, and was free from the faults of his original conception. One of three inches aperture, "the radius of whose curvature was only doubled by that of the aperture," and 46 inches focal length, sustained a magnifying power of 300 and more, and was affirmed to be superior to any Frauenhofer of the same dimensions. MM. Peters, Listing, and Klinkerfues, were cited as authorities for its merits. The latter had been able to obtain an indication of the duplicity of γ Leonis (distance 2·7″) with only 40, and resolved it completely with powers of 60 and 100. The same telescope "also permitted him to see the feeble campanion of β Orionis, as well as a Merz of 49 lines aperture." These statements induced us to apply to Dr. Steinheil, who kindly fitted one of the new 3-inch glasses to a telescope sent him for the purpose. In his catalogue these glasses are rated one-third higher in value than the Frauenhofer pattern, and it is stated that they have "such a mode of setting, that the distance, inclination, and position of the lenses to the optical axis, may be adjusted so as to produce the best effect." They are, in fact, mounted so as to be commanded by six screws, three acting vertically, and three horizontally. Our glass arrived several months ago, with the adjustment disturbed by the journey, and it is possible we have not re-arranged it as perfectly as Dr. Steinheil would have done, nevertheless it possesses remarkable merits. It shows the little Pole-star with 45, when the sky is so light, that, as repeated experiment has shown, ordinary persons could read large print. Castor appears as two minute but distinct discs, with the same power, and in favourable moments a thin dark line of separation appears: γ Leonis is an easy object with about 100, and Sirius when in full blaze is reduced to a clean planetary disc. A power of 300 separates γ Leonis widely, and shows the colours beautifully, and about midnight on the 11th February, when the air was steady, though somewhat misty, the same high power worked admirably on Saturn, showing the brown belts and the very slight openings visible in the ring. We found in these last cases a better effect was produced by the aplanatic eyepiece of Horne and Thornthwaite than by one of the Huyghenian pattern. The state of the weather has precluded our ascertaining the limits of the power of this glass, as, for some time past, good performance upon any object has only been possible on lucky, and often very fleeting occasions. On some of these we succeeded in dividing ζ Orionis.

77th Asteroid, discovered in November 1862, by C. H. F. Peters, Hamilton College, U.S., in size like 12 mag. star.



SMOOTH SNAKE.

Coronella lævis.